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Wastewater Treatment Facilities Twining Water and Sanitation District Taos County, New Mexico

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Environmental Impact Statement

Draft

Wastewater Treatment Facilities

Twining Water and Sanitation District
Taos County, New Mexico

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The Twining Water and Sanitation District has considered alternatives for wastewater management which would solve a pollution problem in the high-quality Rio Hondo watershed of northern New Mexico. The District proposes construction of a new advanced treatment plant with a capacity of 95,000 gallons per day. A major alternative is to rehabilitate the existing plant and provide only the capacity needed to treat existing wastewater flows (83,000 gallons per day). EPA is considering approval and funding of either alternative (as well as providing no funding). Many complex issues bear on EPA's decision, including impacts on water quality, water supply, and socio-economic conditions.

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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION VI
1201 ELM STREET
DALLAS, TEXAS 75270

August 24, 1981

TO ALL INTERESTED AGENCIES, OFFICIALS, PUBLIC GROUPS AND INDIVIDUALS:

Enclosed is a copy of the Draft Environmental Impact Statement (EIS) on the awarding of additional grants under Section 201 of the Clean Water Act for design and construction of upgraded wastewater treatment facilities in the Twining Water and Sanitation District (TWSD), Taos County, New Mexico. The EIS has been prepared concurrently with a wastewater treatment facilities plan under a grant from the U.S. Environmental Protection Agency (EPA).

This document has been prepared in compliance with the National Environmental Policy Act of 1969 and implementing regulations. Written comments or inquiries regarding this EIS should be addressed to Mr. Clinton B. Spotts, Regional EIS Coordinator, at the above address by the date stamped on the cover sheet following this letter.

EPA and the TWSD will hold a public hearing on the Draft EIS and facilities plan at 7:00 p.m., Tuesday, October 20, 1981 in the auditorium of Enos Garcia Middle School on West Kit Carson Road in Taos, New Mexico. I request that individuals and respresentatives of groups wishing to make a statement at the hearing submit a written copy of their proposed statement at the time of the hearing, if possible. Witnesses should limit their testimony to a five minute summary of their written statement. Comments on the Draft EIS will be considered in the preparation of the Final EIS.

If changes required in the Draft EIS are minor, the Final EIS will incorporate the Draft EIS by reference and include only: (1) a revised summary, (2) revisions necessary to the Draft EIS as a result of public comment, and (3) EPA's response to comments made on the Draft EIS. Therefore, the Draft EIS should be retained for possible use in conjunction with the Final EIS. The Final EIS will be sent only to those who request a copy or who make substantive comments on the Draft EIS.

In cases where persons requested only a copy of the summary of the Draft EIS, this transmittal letter accompanies that summary.

A technical reference document containing additional background information has been compiled and may be reviewed along with the Draft EIS, a Spanish translation of the summary of the Draft EIS, and the draft facilities plan at the following locations:

1. Harwood Foundation
 Public library
 LeDeux Street
 Taos, New Mexico

2. Twining Water and Sanitation
 District Offices
 Above the Fire Station
 Taos Ski Valley, New Mexico

3. Taos Pueblo Administrative
 Offices
 Taos, New Mexico

4. Taos Ski Valley, Inc.
 Taos Ski Valley, New Mexico

5. Supervisor's Office
 Carson National Forest
 Cruz Alta Road
 Taos, New Mexico

6. New Mexico Environmental
 Improvement Division
 Taos County Health Building
 Paseo De Pueblo Sur
 Taos, New Mexico

7. New Mexico Environmental
 Improvement Division
 Crown Building
 725 Saint Michael's Drive
 Santa Fe, New Mexico

If you need additional information, please contact Mr. Clinton B. Spotts at (214) 767-2716 or (FTS) 729-2716.

Sincerely,

Frances E. Phillips

Frances E. Phillips
Acting Regional Administrator

DRAFT ENVIRONMENTAL IMPACT STATEMENT

WASTEWATER TREATMENT FACILITIES
TWINING WATER AND SANITATION DISTRICT
TAOS COUNTY, NEW MEXICO

Responsible Agency: U.S. Environmental Protection Agency, Region VI

Action being considered: Possible awarding of design and construction funds for wastewater treatment facilities in the Twining Water and Sanitation District, Taos County, New Mexico.

Cooperating Agencies: U.S. Dept. Agriculture, Forest Service
Carson National Forest

New Mexico Environmental Improvement Division

Contact for further information:

Clinton B. Spotts, Regional EIS Coordinator
U.S. Environmental Protection Agency, Region VI
1201 Elm Street
Dallas, Texas 75270
Phone: Commercial (214) 767-2716
FTS 729-2716

Abstract: The Twining Water and Sanitation District has considered alternatives for wastewater management which would solve a pollution problem in the high-quality Rio Hondo watershed of northern New Mexico. The District proposes construction of a new advanced treatment plant with a capacity of 95,000 gallons per day which would allow about 20 percent growth. A major alternative is to rehabilitate the existing plant, add phosphorus treatment, and provide only the capacity needed to treat existing wastewater flows (80,000 gallons per day). EPA is considering approval and funding of either alternative (as well as providing no funding). Many complex issues bear on EPA's decision, including impacts on water quality, water supply, and socio-economic conditions.

Date Comments Due:

Responsible Official: Frances E. Phillips

Frances E. Phillips
Acting Regional Administrator

CHAPTER 1
SUMMARY

1. SUMMARY

1.1 EXISTING PROBLEMS

The Twining Water and Sanitation District (TWSD) is responsible for wastewater management for the resort complex of Twining, commonly known as Taos Ski Valley. Figure 1-1 illustrates the general location of Twining with respect to other communities in Taos County, which is in Northern New Mexico. TWSD owns and operates an existing sewer system and treatment plant which serves recreational, commercial and residential facilities in the base area of the resort complex. The existing facilities have long been and remain a source of pollution which has adversely affected the high-quality waters of the Rio Hondo. Past problems related to excessive discharges of organic matter, solids and bacteria have largely been controlled by recent improvements to the treatment plant. However, treatment would improve if infiltration problems were corrected. Also, the existing plant must be modified or replaced in order to comply with proposed regulations requiring the control of the nutrient phosphorus. Full protection of water quality in the Upper Rio Hondo may require control of non-point pollution sources such as runoff from the base area, erosion of fertilized ski trails and discharges from septic tanks and cesspools. Runoff control measures are discussed in the U.S. Forest Service Draft Environmental Impact Statement, proposed Taos Ski Valley, Inc. master development plan, April 1981.

A major issue concerning alternative solutions to the existing problems is whether or not any treatment facilities should provide capacity to accommodate further development in the resort area. TWSD intends initially to provide sufficient treatment capacity to allow an approximate 20 percent increase in the sale of lift tickets and a 50 percent expansion in base area overnight accommodations; additional expansion for overnight visitors may occur if stream quality can be protected. This development is opposed by groups representing downstream residents who are concerned that the growth will harm the water quality and quantity of the Rio Hondo and will have adverse effects on the socio-economic environment of the area.

1.2 PROJECT ALTERNATIVES

The no action alternative would fail to solve the existing pollution problem and is not acceptable. Fifteen specific treatment alternatives were evaluated as shown in Table 1-1 based on eight issues: cost; engineering reliability; impacts on water quality and water supply; construction and land use (growth) impacts; potential for community conflict; and benefit to the region. For example, alternatives rated 1 as to cost are the least expensive options. Costs presented represent total annual costs over a 20-year period and include construction and operation and maintenance costs.

a. the widespread use of septic tanks (alternative 3) would have unacceptable water-quality impacts;

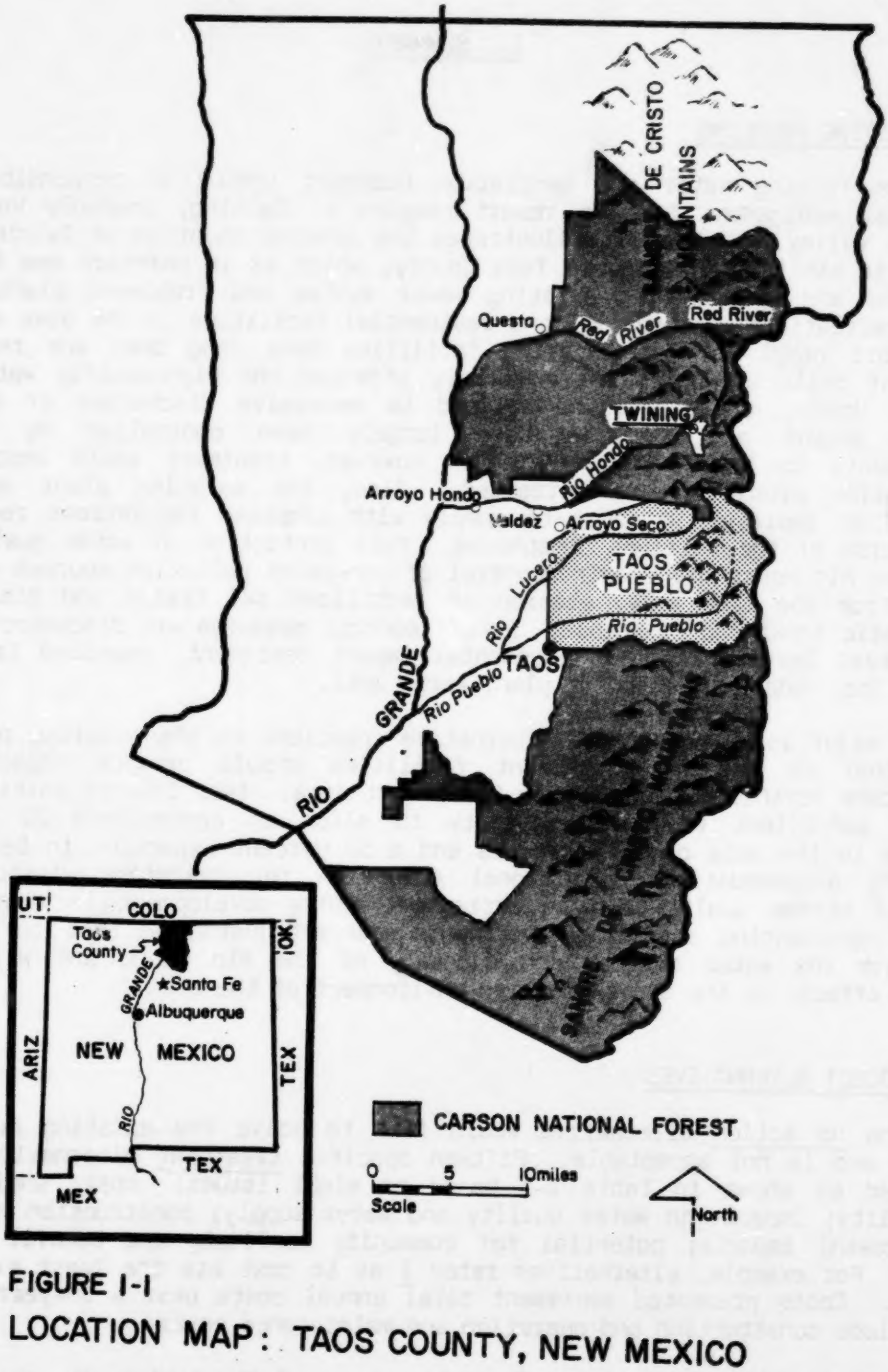

FIGURE 1-1
LOCATION MAP: TAOS COUNTY, NEW MEXICO

TABLE 1-1. EVALUATION OF FIFTEEN TREATMENT ALTERNATIVES.

ISSUES are identified by letter, as follows. A = Cost. B = Reliability. C = Water quality. D = Water supply. E = Construction impacts. F = Land use (growth). G = Community conflict. H = Benefits to region.

Name of alternative	Brief description of alternative	Ratings on ISSUES [a]								Pros = reasons which might lead some people to favor an alternative. Cons = reasons which might lead some people to reject an alternative.
		A	B	C	D	E	F	G	H	
1. Conventional new plant	Build new plant in Twining using advanced technology which needs energy, chemicals	1	2	2	2	1	2	1	3	Pros: "conventional" approach Cons: energy use; complex operation
2. Aquaculture	Build new plant in Twining using new technology which grows algae in ponds inside a greenhouse	1	2	2	2	1	2	1	2	Pros: very progressive in its use of resources; comparatively inexpensive Cons: too new an idea to know how well it will work
3. Septic tanks	Abandon the sewer system; everyone uses septic tanks	1	1	3	2	1	1	1	3	Pros: "conventional" approach; inexpensive; simple Cons: will not solve the pollution problem
4. Greywater/ blackwater	Some sewage goes to existing (renovated) plant; toilet wastes to composting toilets	2	3	2	2	1	2	1	3	Pros: very progressive in its use of resources Cons: expensive; reliability uncertain
5. Storage and discharge	Store the winter sewage and discharge it in spring when river can better assimilate nutrients	1	2	3	1	1	2	1	3	Pros: may improve downstream water supplies in terms of quantity; inexpensive Cons: may not solve pollution problem
6. Total detention	Pipe sewage to ponds near Arroyo Seco and evaporate it	3	1	1	3	3	2	2	2	Pros: simple; takes Twining sewage out of Rio Hondo Cons: expensive; wasteful of water; water rights would be needed
7. Land application (farming)	Pipe sewage to ponds near Arroyo Seco and let farmers use it for irrigation	2	2	2	1	3	2	3	2	Pros: supports farming; not too expensive Cons: requires agreement of farmers, and some type of legal arrangement with Twining
8. Pipeline to Rio Grande	Renovate existing Twining plant; build pipeline to Rio Grande (west of Arroyo Hondo) and discharge sewage there	2	2	1	3	2	2	2	3	Pros: takes Twining sewage out of Rio Hondo Cons: water rights would be needed; major construction impacts
9. Holding tanks	Store sewage in ponds in Twining and use trucks to haul it to the Town of Taos sewage plant	1	2	1	3	1	2	2	3	Pros: simple, relatively inexpensive; eliminates pollution in Rio Hondo Cons: uses energy; heavy truck traffic; water rights would be needed
10. Regional plant in Hondo Valley	Pipe sewage to a new regional sewage plant near Arroyo Hondo	2	3	1	3	3	3	3	1	Pros: eliminates pollution in Rio Hondo; could provide sewers for downstream residents Cons: major land use changes could occur in Hondo Valley; major construction impacts; water righ would be needed
11. Regional plant in Taos	Pipe sewage to Town of Taos sewage plant	2	3	1	3	2	3	3	1	Pros: takes Twining sewage out of Rio Hondo; could provide sewers for Arroyo Seco-El Prado area Cons: major land use changes could occur near Taos; major construction impacts; water rights would be needed
12. Rehabilitation	Renovate existing plant and add on advanced processes for nutrient removal	1	3	2	2	1	2	1	3	Pros: "conventional"; relatively inexensive Cons: reliability is questionable
13. Total treatment	Build very complex plant in Twining which would turn sewage into drinking water for use by Twining	3	3	1	2	1	2	1	3	Pros: takes Twining sewage out of Rio Hondo, without adverse effects on flows Cons: extensive energy and chemical use; very expensive; against federal, state regulations
14. Greywater evaporation	Combine alternatives 4 and 6: compost toilets, greywater evaporation	3	3	1	3	3	2	2	2	Pros: simple; takes Twining sewage out of Rio Hondo Cons: expensive; reliability uncertain; wasteful of water; water rights would be needed
15. Aquaculture + snowmaking	Combine alternatives 2 and 5	2	2	3	1	1	2	1	2	Pros: progressive in use of resources; would increase spring and summer runoff Cons: some questions about reliability; may not solve pollution problems

a. 1 = less impact (best rating); 2 = intermediate impact; 3 = more impact.

b. construction of conventional treatment facilities (alternatives 1 and 12) would be comparatively inexpensive (on the order of $120,000 to $150,000 per year to serve existing development) and generally have less adverse environmental impacts than other choices.

c. Innovative processes (alternatives 2, 4, 5, 13, 14, 15) are generally much more expensive ($270,000 per year or more for total treatment or a combination blackwater-greywater system). Aquaculture is cost-competitive with conventional systems but may not be reliable in a high mountain setting. Use of effluent for snowmaking probably would result in violation of water-quality standards.

d. Regional concepts, involving treatment facilities in downstream areas (alternatives 6-11) could benefit some persons outside Twining but would generally have severe adverse impacts on water supply, land use and community relations. After considerable public discussion, all such alternatives were opposed by the people of the area.

Of the fifteen alternatives, construction of a new plant or rehabilitation of the existing plant appear to be the most cost-effective; aquaculture could be acceptable if a pilot plant were successfully operated. The facilities plan engineer considers a new plant to be the most reliable choice for meeting water-quality objectives, which is an important consideration in a basin where past treatment failures have caused environmental damage.

Seven capacity alternatives range in size from 75,000 gallons per day (gpd) to 148,000 gpd. As a practical matter, discharges would be limited to 95,000 gpd based on proposed levels of treatment and the assimilative capacity of the Rio Hondo, unless and until a larger flow can be demonstrated to meet water-quality objectives. Table 1-2 compares the impact of the two most representative capacity alternatives: B (an 80,000 gpd plant which would allow hookups of existing base facitities but provide for no new hookups and thus no increase in skier capacity nor any new high-density commercial development); and E (a 95,000 gpd plant which would permit an increase in the daily skier limit from 4050 to 4800, and which would service nearly 500 new pillows in the base area).

Community opinion regarding alternatives B and E is sharply divided. On the one hand there are substantial economic benefits to the Taos region from increased skier use at Twining, and these benefits are greater from alternative E than alternative B. Moreover, growth in Twining is not constrained by any legal limitations and is viewed by some as inevitable. (Indeed, if water quality requirements are met and county zoning is not adopted, an even larger plant could be built in the future.) Thus a 95,000 gpd plant is seen by many as both necessary and as providing substantial economic benefit to the community by servicing an expanding winter tourism industry.

However, negative impacts (including more traffic, more water use, and more potential discharge from non-point sources) also increase with growth. Many citizens believe that any wealth created by winter tourism is not equally

TABLE 1-2. IMPACTS OF CAPACITY ALTERNATIVES.

Impacts from Alternative B relate to: no increase in skier limit (remains at 4050); increased visitation during off-peak periods (winter); small increase in summer; 470 new pillows in 94 new cabins (added to 295 existing pillows); no increase in commercial facilities (remain at 931 pillows); see Tables 6-7, 6-8, 6-9. In reality, impacts associated with alternative E would probably also occur from alternative B, but serviced by on-site systems rather than a central treatment plant.

Impacts from alternative E would include all changes listed for alternative B, plus increase in skier limit from 4050 to 4800, proportional (20 percent) increase in off-peak use; expansion/construction of lodges and condos to provide for 50 percent more overnight capacity in commercial facilities of base area (489 new pillows added to 931 existing) [a]. As stated above, all these changes could occur under alternative B; however, alternative E would facilitate these changes. Impacts marked with asterisk (*) could occur outside Twining if skier limit is increased, but overnight capacity is not (symbolically this should be achieved by alternative D).

Factor	Alternative B (80,000 gpd)	Alternative E (95,000 gpd)
Populations; see Tables 6-7, 6-8, 6-9	Peak day remains at 4705 Overnight capacity increase from 1226 to 1696 Annual visitation increase from 275,000 to 520,000	Peak day increase to 5579 Overnight capacity increase from 1696 to 2185* Annual visitation increase from 520,000 to 615,000 If half new jobs in Twining taken by existing residents, then 38 persons would immigrate to region because of increased employment
Water Resources; see Section 6.2.7	Reduce pollution due to improved wastewater treatment; increase in potential non-point source pollution from cabins (but may be controlled - see 5.4.2); potential decrease in other non-point sources (see 5.4.7)	Reduce pollution due to improved wastewater treatment (but, if plant should fail, pollution would be greater than from B); potential increase in non-point source pollution from cabins (but may be controlled - see 5.4.2); more potential for construction impacts* (see Table 6-1); potential decrease in other non-point sources (see 5.4.7)
	Need for 11 acre-feet/year of water rights (including expanded snowmaking); can be obtained from rights already held by TSV, Inc. and/or TWSD	Need for 4 additional acre-feet of water rights beyond impacts of alternative B; of these 1 AFY would be for the skier limit increase and 3 AFY* would be for the increase in overnight capacity; can be obtained from rights already held by TSV, Inc. and/or TWSD
	Increase in annual visitation would require an additional 5 acre-feet of rights outside of TWSD (e.g. Amizette, Valdez, Arroyo Seco or wherever the skiers are lodged)	Could reduce the demand for regional water rights from 5 to 2 AFY because skiers stay in Twining, not elsewhere*
	The historic decline in streamflow in the Rio Hondo would not be significantly affected by either alternative because it is caused by reforestation of the watershed and reduced snowfall, and not by development at the ski valley	
Traffic, Air Quality, Noise (See Section 6.5, Table 6-8, 6-9)	Peak traffic stays at 1650 cars/day Total traffic increase from 104,000 vehicle-trips per year to 196,000 vehicle trips per year [b]	Peak traffic increases by 310 cars to 1960/day Total traffic increase from 196,000 to 233,000 vehicle trips per year [b]
	Air emissions, noise and energy use increase proportionally but standards not violated	Air emissions, noise and energy use increase proportionally but standards not violated
Economics [c] (See Table 6-8, 6-9)	Increase in revenues from $27.5 million to $52 million/year; jobs remain at 1560	Increase in revenues from $52 to $61.5 million per year; 190 additional jobs (total 1750)
Culture; Sensitive Resources (See Section 6.5, 6.6.6)	Growth/impacts part of complex factors which influence changes in traditional agrarian society; significance of impacts widely debated	Similar to B but: more tourist influx and cash flow; greater portion of tourists lodge in TWSD*
	Possible increase in use of wilderness area and trespass on Indian lands (but small compared to problems if area becomes summer resort)	Similar to B, but slightly greater because of more skiers and overnight residents*
Other (See Table 6-1; Section 6.7, 6.6.7)	Construction on 94 cabin lots; improvements in ski area as described in USFS (1981) and Table 6-6; construction at treatment plant; investment of energy, chemical and money to improve wastewater treatment; much higher sewer rates than at present	Similar to B except: addtional construction on 3 - 5 acres of base area*; increase in rates more widely shared

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a. If the District were to so allow, some or all of this change could occur in high-density development using independent treatment systems.

b. Assumes no benefits from shuttle service or from reduced commuting which may result from expanded lodging in Twining.

c. Values are for a good ski year and, as discussed in Table 6-9, more than half occur in Taos region, not in Twining.

shared among community members, but rather adds to the many stresses which threaten the survival of the established Indian and Hispanic culture. These residents - including many living downstream of Twining - believe that as a matter of equity an 80,000 gpd plant is more appropriate until TWSD can demonstrate that its facility will reliably solve existing water pollution problems. They propose that if and when TWSD is in full compliance with all regulations, expansion of the facility would be possible using private funds - that is, at the direct expense of those who benefit. The debate over the capacity alternatives has been sharp and without apparent consensus to date. At least in part this may reflect widely different individual perceptions about what is 'best' for the Taos area.

The District has made a preliminary decision (subject to public input on this EIS) to select alternative 1 (conventional treatment plant). Design capacity would be 95,000 gpd but actual flows would be gradually expanded from 80,000 gpd.

A large number of other alternatives being considered by the District relate to specific components of wastewater management. In general, it appears to be most cost-effective to: rehabilitate the sewer system to control infiltration; actively manage on-site systems; use advanced on-site disinfection techniques to more fully protect the quality of the Rio Hondo; increase water-conservation efforts, especially through use of dry toilets or extremely low-flush toilets; design rates to recover costs from those who use the area. Of particular importance are alternatives being considered by the District for ensuring that water-quality objectives are indeed met by any new facilities. The primary options include: adoption of an expansion policy, in which new hookups would be contingent on plant performance; and value engineering analysis of plant design, construction and operation.

1.3 EPA ALTERNATIVES

EPA may choose to fund all, part, or none of the District's preferred alternative or some other alternative. In reaching its decision, EPA believes that decisions about regional growth and land use must be made at the local level; the agency will not impose its judgment as to the appropriate future for the region. Rather, EPA will act within the constraints of the choices which are available, will evaluate impacts such as identified in Table 1-2, will consider community input and comments concerning the DEIS, and will identify the process and capacity alternative which it deems to be the most cost-effective. Any decision to limit or deny funding would not remove the District's responsibility to improve its treatment works.

1.4 OTHER FEDERAL AND STATE AGENCY ALTERNATIVES

The New Mexico Environmental Improvement Division has funding options parallel to those available to EPA.

The U.S. Forest Service administers the site of the existing treatment plant through a special use permit and must approve any construction or expansion of new facilities on National Forest Land. Also, Taos Ski Valley Inc. has prepared and the Forest Service has approved (with modifications) expanded parking facilities and various up-mountain improvements in the ski area. Implementation of the improvements awaits resolution of appeals to the USFS decision to approve the plan. When implemented, the agency will oversee the control of non-point source pollution from these actions and thus shares with TWSD responsibility for protection of the overall quality of the Rio Hondo.

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CHAPTER 3
INTRODUCTION

3. INTRODUCTION

3.1 BACKGROUND ON APPLICANT AND APPLICATION

The resort complex known as Taos Ski Valley is located in northern New Mexico, approximately 20 miles northeast of the Town of Taos (Figure 3-1). The resort contains recreational, commercial and residential facilities capable of accommodating more than 4,000 day visitors and about 1,200 overnight visitors and residents; the permanent population is on the order of 50 persons. Water and sewer services are provided by the Twining Water and Sanitation District (TWSD), a legal subdivision of the State of New Mexico which incorporates a 267-acre area of the Rio Hondo drainage basin (see Figure 4-1). In this report, the terms 'TWSD' and 'the District' will be used interchangeably with the name Twining.

As discussed in chapter 4, the wastewater facilities owned and operated by TWSD have a long history of inadequate performance which has resulted in pollution of the high-quality waters of the Rio Hondo. Although recent improvements to the facilities have significantly improved the situation, problems remain. TWSD is a designated management agency (DMA) in the New Mexico state-wide Water Quality Management Plan. As a DMA, TWSD is responsible for wastewater facilities management within its area of jurisdiction and can apply for grants for wastewater treatment facilities improvement. TWSD has applied for and received such a grant to prepare a facilities plan for improvements to its wastewater collection and treatment system. The plan is to provide a framework for wastewater management decisions through the year 2000. Funding of 75 percent of the planning costs is provided by U.S. Environmental Protection Agency (EPA) under grant number C-35-1064-01. The New Mexico Environmental Improvement Division (EID) and TWSD pay the remainder of the planning costs in equal shares. Burton, Leyendecker and Leyendecker, an engineering firm located in Albuquerque, New Mexico, is preparing the facilities plan.

3.2 EPA LEGISLATIVE AUTHORITY AND RESPONSIBILITIES

Decisions made by TWSD about water and wastewater management are partly dependent upon the laws, regulations, and grant programs of the Federal government, especially the Congressional mandates known as the Clean Water Act and the National Environmental Policy Act.

Clean Water Act. In 1972 Congress enacted Public Law 92-500, Amendments to the Federal Water Pollution Control Act, in order to establish a comprehensive program which would "restore and maintain the chemical, physical and biological integrity of the Nation's waters". Because municipal sewage is one of the major point sources of water pollution in the U.S., Title II of the new law provided for an expanded program of federal assistance in the construction of sewage treatment facilities, and gave the Environmental Protection Agency

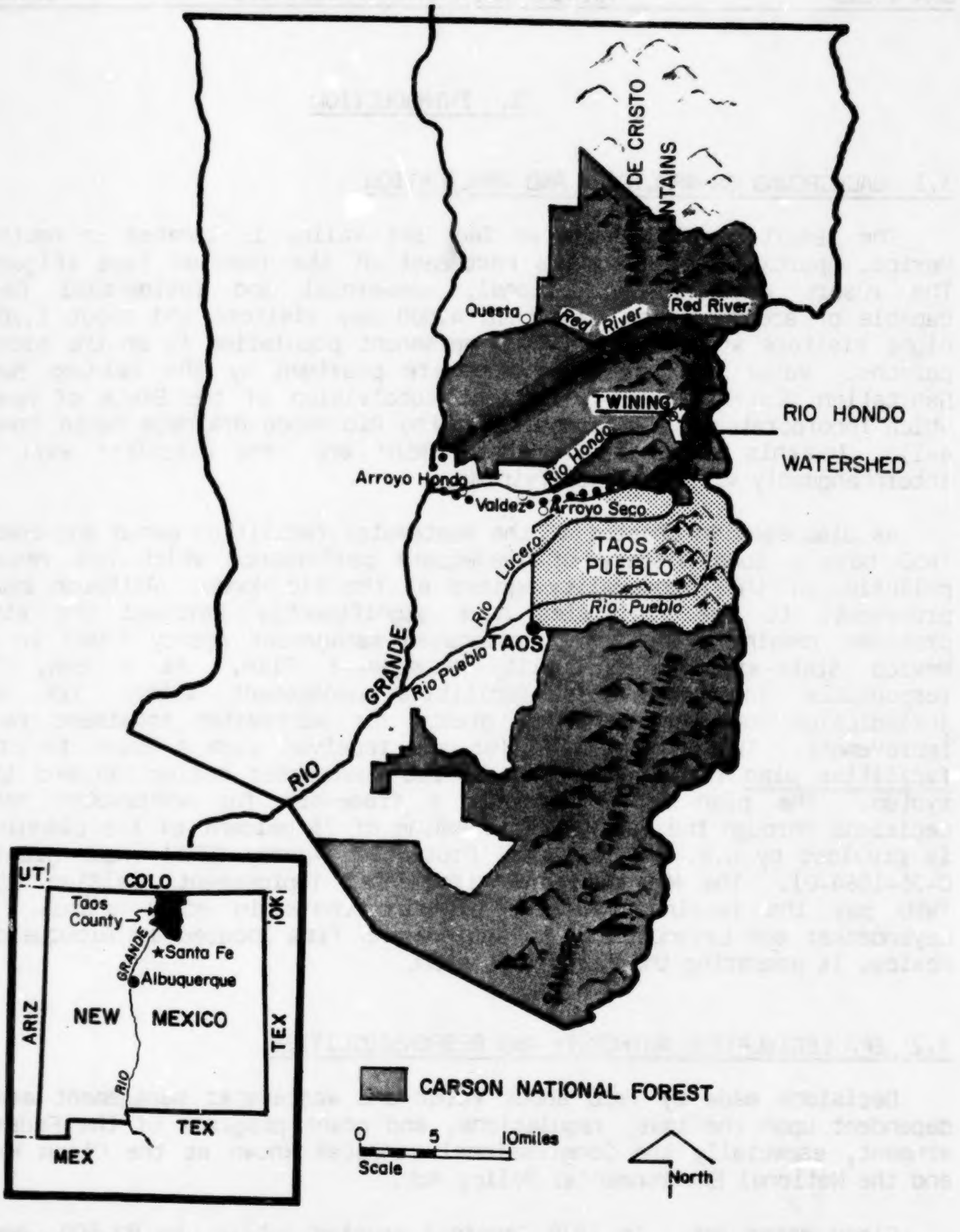

FIGURE 3-1
LOCATION MAP: TAOS COUNTY, NEW MEXICO

(EPA) authority to fund such activities, provided that state and local governments supply 25 percent of the necessary financial support. The EPA grants are normally given in three steps or phases: I. initial planning; II. detailed design; and III. actual construction. Under the law the initial planning phase is emphasized, and must provide a long-range look at a wide range of alternatives for the collection, treatment and ultimate disposal of waterborne wastes. Actions which promote the reclamation and reuse of wastewater are especially encouraged by the Act, as is clean-up of wastes to the point that no discharge of pollutants occurs from a treatment facility.

Public Law 92-500 requires that a permit be issued for any wastewater discharge to the waters of the U.S. The permit system is referred to as the National Pollutant Discharge Elimination System (NPDES). Compliance with the water-quality requirements of a wastewater plant's NPDES permit is a mandatory objective of the facilities planning process.

In 1977 Congress passed Public Law 95-217, which revised portions of the 1972 Act. Collectively, the complete amended act is referred to as the Clean Water Act (CWA). Emphasis was placed upon giving planning consideration to innovative technologies for water reuse, energy conservation and/or complete removal of pollutants. Selection of innovative alternatives is encouraged by the availability of 85 percent Federal participation in facility design and construction, instead of the conventional level of 75 percent funding.

EPA has evaluated whether or not TWSD is eligible for EPA funding. A 1976 opinion of the New Mexico Attorney General (Anaya, 1976) states that TWSD is a legally formed sanitation district under the laws of the state, notwithstanding its basic commercial nature. The EPA Regional Counsel has determined that sanitation districts formed under New Mexico law are eligible for EPA construction grants (EPA, 1979b).

National Environmental Policy Act (NEPA). NEPA is Public Law 91-190, and was signed in 1969. There are six specific environmental objectives of federally-funded actions, set forth in section 101(b) of NEPA as follows.

1. To fulfill the responsibilities of each generation as trustee of the environment for succeeding generations.

2. To assure for all Americans safe, healthful, productive and aesthetically and culturally pleasing surroundings.

3. To attain the widest range of beneficial uses of the environment without degradation, risk to health or safety, or other undesirable or unintended consequences.

4. To preserve important historic, cultural, and natural aspects of our national heritage, and maintain, wherever possible, an environment which supports diversity, and variety of individual choice.

5. To achieve a balance between population and resource use which will permit high standards of living and a wide sharing of life's amenities.

6. To enhance the quality of renewable resources and approach the maximum attainable recycling of depletable resources.

NEPA also provides that an Environmental Impact Statement (EIS) be prepared by federal agencies which propose a major action that significantly affects the quality of the human environment. The EIS must provide information to be used in federal decision-making. Section 102(2)(c) of NEPA requires the EIS to consider:

a) the environmental impact of the proposed action;
b) any adverse environmental effects which cannot be avoided should the proposal be implemented;
c) alternatives to the proposed action;
d) the relationship between local short-term uses of man's environment and the maintenance and enhancement of long-term productivity; and
e) any irreversible and irretrievable commitments of resources which would be involved due to the implementation of the proposed action.

EPA's decision to prepare an EIS on the Twining project is discussed in section 4.2. Based on the most recent regulations regarding EIS preparation (CEQ, 1978; EPA, 1979c), the document is to concentrate on key issues as determined through an early public "scoping" process, and as further defined during an extensive public participation process. The public participation program normally includes the formation of a Citizens Advisory Committee of local citizens to provide review and advice in the Facilities Plan and EIS process. The EIS must provide a concise analytical statement which concentrates on evaluation of real alternatives; for most projects the document should contain less than 150 pages.

The EIS process includes cooperation with all federal and state agencies which have management responsibilities for key environmental resources. Table 3-1 lists agencies normally concerned with wastewater projects in New Mexico. Chapter 7 documents the public participation program during EIS preparation and describes the process of coordination and review which will apply to the Draft EIS. A chapter of the Final EIS will include all public comments on the Draft, and EPA's responses to these comments.

3.3 INVOLVEMENT OF OTHER AGENCIES

In addition to the general coordination associated with any wastewater EIS (Table 3-1), EIS preparation mandates consideration of project-related decisions which may be made by governments or agencies other than EPA. In the specific case of Twining, any decisions made regarding wastewater management may interact with decisions of the U.S. Forest Service (USFS), New Mexico Environmental Improvement Division (EID), County of Taos, and Taos Pueblo.

TABLE 3-1. INTERAGENCY COORDINATION RESPONSIBILITIES.

While all coordination needs to be documented in the EIS, items with an asterisk (*) represent major, mandatory elements of the consultation process.

EPA Coordination Responsibilities1/	Coordinating Agencies and Responsibility	Authority
HISTORICAL AND ARCHAEOLOGICAL SITES		
Identify properties listed on or eligible for listing on the National Register of Historic Places that may be affected by the undertaking.* Identify effects of undertaking on those properties.	State Historic Preservation Officer; Advisory Council on Historic Preservation; National Park Service: Identify existing and potential Register properties and comment on findings of environmental document.* Undertake data recovery and preservation activities if the undertaking may cause irreparable loss or destruction of significant scientific, prehistoric or archaeological data.	National Historic Preservation Act of 1966, as amended; Archeologic and Historic Preservation Act of 1974; Reservoir Salvage Act of 1960; and Executive Order 11593, entitled "Protection and Enhancement of the Cultural Environment."
WETLANDS PROTECTION AND FLOODPLAIN MANAGEMENT		
Determine if proposed actions will be in or affect wetlands. If so, prepare a wetlands assessment as part of the environmental document. Identify flood hazard areas as they are related to existing and proposed facilities.	U.S. Army Corps of Engineers: Make wetland determinations. Federal Emergency Management Agency: Provide flood hazard maps of the planning area.	Executive Order 11990, Protection of Wetlands; EPA's Statement of Procedures on Floodplain Management and Wetlands Protection (January 5, 1979). Executive Order 11988, Floodplain Management; Flood Insurance Act of 1968; Flood Control Act of 1970; National Flood Disaster Protection Act of 1973; refer also to Wetlands Protection.
Request preliminary determination of need for permits for construction in a waterway, as relates to dredge and fill activities.	U.S. Army Corps of Engineers: Comment on findings of environmental document as may relate to Corps projects; indicate likelihood of need for Section 404 or Section 10 permits.	Section 404 of Clean Water Act of 1972; Section 10 of the Rivers and Harbors Act of 1899.
AGRICULTURAL LANDS		
Request identification of significant agricultural lands in the planning area. Evaluate impacts of the proposed action and recommend mitigation measures.	State and/or Area Conservationist, U.S. Soil Conservation Service: Identify significant agricultural lands, such as reported in the Important Farmland Inventory.	EPA's Policy to Protect Environmentally Sensitive Agricultural Lands (September 8, 1978); memo from CEQ to Heads of Agencies on "Analysis of Impacts on Private or Unique Agricultural Lands in Implementing the National Environmental Policy Act", September 8, 1980.
WILD AND SCENIC RIVERS		
Request identification of designated or nominated Wild, Scenic or Recreational rivers under the Wild and Scenic Rivers Act. Identify and avoid or mitigate all impacts to such rivers.	National Park Service; State Scenic Rivers Administrator; Bureau of Land Management; U.S. Forest Service: Identify Wild and Scenic rivers. Comment of findings of environmental document.	Wild and Scenic Rivers Act of 1968; Water Resources Planning Act of 1965.
FISH AND WILDLIFE		
Identify and determine impacts to flora and fauna and to any natural stream or body of water and consult with reviewing agency on mitigating, preventing or compensating for project-related losses of wildlife and to enhance other resources.	U.S. Fish and Wildlife Service; State Department of Game and Fish: Comment on findings of the environmental document.	Fish and Wildlife Coordination Act of 1958.

TABLE 3-1. INTERAGENCY COORDINATION RESPONSIBILITIES. (continued).

EPA Coordination Responsibilities1/	Coordinating Agencies and Responsibility	Authority
ENDANGERED SPECIES PROTECTION		
Request identification of all designated and proposed endangered or threatened species and critical habitats in the area. Prepare biological assessment of endangered species and/or critical habitats if necessary.	U.S. Fish and Wildlife Service; State Department of Game and Fish: Identify endangered species or habitats, including formal review by the Office of Endangered Species if required under Section 7 of the Endangered Species Act.	Endangered Species Act of 1973.
AIR QUALITY		
Assess direct and indirect impacts of the project on air quality. If there are possible significant adverse effects, consult with the state or local agency to ascertain conformity of the action to the State Air Quality Implementation Plan (SIP). Determine if any increased emissions are allowable or will be offset.	N.M. Environmental Improvement Division (NMEID), Air Quality Bureau: Assist with assessment of project impacts. Respond to request for conformity concurrence.*	Clean Air Act, as amended, 1977.
OTHER: PUBLIC LANDS, NOISE, WATER QUALITY, OTHER STATE AND LOCAL CONCERNS		
Consult with appropriate agencies and assess impacts. Submit draft environmental document to A-95 Clearinghouses for review.[2] Identify NPDES standards and violations, and relationship of project to the Clean Water Act. Assess conformance to the Section 208 Areawide Wastewater Management Plan. Access conformance to other State and local plans, such as recreation and open space, economic development and county and municipal plans.	U.S. Forest Service; U.S. Bureau of Land Management; State Planning Office; Council of Governments; NMEID; of Governments; NMEID: Comment on findings of environmental document*; opportunity for comment from local Council of Governments and State Planning Office required.	NEPA and Clean Water Act; Noise Control Act of 1972; Federal Insecticide, Fungicide and Rodenticide Act; as amended; Resource Conservation and Recovery Act; Toxic Substances Control Act; Safe Drinking Water Act; Office of Management and Budget Circular A-95.

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1. EPA refers to EPA or persons acting on behalf of EPA or the grantee.
2. Office of Management and Budget Circular A-95 requires that State and areawide "clearinghouses" coordinate Federally-funded projects.

Sources:
a) EPA, 1978. Implementation of procedures on the National Environmental Policy Act. 44FR 64174-64193, Nov. 6, 1979, 40 CFR Part 6.
b) EPA Region 6, 1978. Instruction for preparing environmental information documents for construction grants projects. CG-99, revised 11/8/78.
c) Spotts, Clinton B., August 1979. Working guidelines for the preparation of environmental impact statements.
d) EPA, 1979. Environmental assessment of construction grants projects. EPA-430/9-79-007.

USFS and EID have some direct involvement in facilities planning in Twining, as described in part C of section 5.

U.S. Forest Service. The TWSD treatment plant is located on lands of the Carson National Forest; ski trails, lifts and some other facilities developed by Taos Ski Valley, Incorporated (TSV, Inc.) also occur on forest land. TSV, Inc. has prepared a 30-year master plan which proposes to limit lift-ticket sales to approximately 4,800/day, and which proposes new parking facilities, ski lifts and trails. The Forest Service has published a Draft and Final EIS on the master plan (USFS, 1981a; and 1981b). The EIS is limited to facilities which relate directly to skier use of the area and does not discuss potential development which may occur on private land. Section 6.6.1 characterizes the master plan.

USFS permits issued to TWSD and TSV, Inc. include general stipulations to maintain water quality (see Appendix A). USFS and EPA have agreed that since EPA is the federal agency responsible for water pollution control, EPA should take the lead in enforcing any federal water quality requirements which apply to Twining. Water quality from non-point sources on recreational lands is addressed in the Forest Service EIS.

EID. The State of New Mexico, through the Water Quality Control Commission and EID, establishes wastewater planning priorities in New Mexico (Twining is number 2 on the 1981-82 draft priority list) and contributes 12.5 percent of the funding to Section 201 wastewater projects. EID also is the lead agency for enforcement of water-quality regulations. Additional duties of the agency include development of wasteload allocations for future NPDES permits and administration of on-site wastewater system regulations and the State ground-water discharge regulations.

County of Taos. The County is the only agency with the power to regulate land use in Twining. The County currently has extensive regulations with respect to subdivision activity involving five or more lots. The County has yet to use its other powers to control land use and at present there are no zoning laws in effect in unincorporated areas of the County (except extraterritorial zoning by the Town of Taos).

Taos Pueblo. Taos Indian Pueblo land lies south of, but not adjoining, the TWSD (Figure 3-1). The Pueblo has a general interest in the quality and quantity of all headwaters in the area that touch the Pueblo directly or are considered as sacred lands and waters to the tribe (Bernal, 1981; Jiron, 1974). Consideration of these interests by federal agencies is guaranteed by the American Indian Religious Freedom Act (Public Law 95-341). Specifically, the Act guarantees access to sites, such as sacred lands and cemeteries; sacred objects, including those gathered, transported and possessed by museums; and ceremonies and traditional rites, as they relate to federal agency practice.

For New Mexico, there is specific concern for all lands traditionally occupied and traveled by Pueblo Indians, the abililty to commune with those lands, and the need for protection of ecologically sensitive lands and waters of religious significance, with no federal actions taken to diminish or degrade natural flows taken without due consultation with affected tribes (USDI, 1979).

CHAPTER 4
PURPOSE AND NEED

CHAPTER 4. PURPOSE AND NEED

4.1 PROBLEMS WHICH NEED TO BE ADDRESSED

A large number of issues have been raised concerning wastewater management in the Twining Water and Sanitation District (TWSD). This section provides a brief overview of two issues which are especially critical to decision-making: existing water pollution in the Rio Hondo; and the environmental impacts of any growth which could occur as the result of new wastewater facilities. Each discussion is followed by references indicating where more detailed information may be found.

Water Pollution. The Rio Hondo is a high-quality mountain stream. The State of New Mexico has adopted stringent stream standards intended to protect the river against significant degradation. These standards are listed in Table 4-1; recent proposed changes are discussed in section 6.2.2. Water meeting these standards is considered suitable for use as a drinking water supply (but only after disinfection), and for fish, irrigation, livestock and wildlife water, and boating. The standards do not require the river to be maintained in an absolutely pure state.

In 1967 a predecessor of TWSD constructed sewers and a central treatment plant in Twining. Figure 4-1 shows the District boundaries and the location of the existing wastewater management facilities. These facilities are subject to numerous environmental regulations, including effluent limitations which strictly limit the amount of pollution which may be discharged to the Rio Hondo. Table 4-1 lists two sets of effluent limitations for the Twining treatment plant - existing limitations which have been in effect for the last several years, and more stringent limitations which would be imposed to obtain full compliance with proposed changes in the stream standards.

The Twining treatment plant was a source of river pollution almost from its inception. Problems included poor design and construction of sewers and the plant itself, and excess water (called infiltration) which has seeped into sewers, causing overloading of the plant. TWSD's operation of the facilities generally was not adequate. The problems were most severe in winter, when flows into the plant are large due to the influx of skiers, and the facility has not been able to provide adequate treatment of the sewage.

Violations of the existing effluent limitations were common throughout the middle and late 1970's; as a result the Rio Hondo contained excessive amounts of organic material, suspended solids, bacteria and other contaminants. The effluent from the plant caused some violations of the stream standards and damaged aquatic life. The most frequent problems were for bacteria, chlorine, ammonia, and phosphorus. The problems were concentrated within a few miles downstream of the sewage plant. By the time the river reached the mountain front above Valdez, the quality of water met the state standards again. The

TABLE 4-1. STREAM STANDARDS AND EFFLUENT LIMITATIONS.

mg/l = milligrams per liter. gpd = gallons per day. All standards are maximums (not to be exceeded) except pH (range) and dissolved oxygen (minimum value).

Parameters & Units	New Mexico Stream Standards [a]	New Mexico Effluent Regulations [b]	Existing NPDES Effluent Limitations [c] (30 day average)	Proposed Effluent Limitations [d] (30 day average)
Biological Oxygen Demand (5-day) (mg/l)	-	30	30	30
Chemical Oxygen Demand (mg/l)	-	125	-	-
Total Suspended Solids (mg/l)	-	-	30	30
Settleable Solids (ml/l)	-	0.5	-	-
Fecal Coliforms (colonies per 100 ml)	100	500	200 [e]	500
pH	6.6 to 8.8	6.6 to 8.6	6.0 to 9.0	6.6 to 8.6
Chlorine Residual (mg/l)	0.002	-	0.01	0.04
Flow or Discharge (gpd)	-	-	30,000	-
Total Ammonia Nitrogen (mg/l)	(0.2) [f]	-	-	30 [g]
Un-ionized Ammonia as N (mg/l)	0.02* [f]	-	-	-
Conductivity (micromhos)	400	-	-	-
Dissolved Oxygen (mg/l)	6.0 or 85% saturation, (whichever is higher)	-	-	-
Nitrate-nitrogen (mg/l)	(0.8) [f]	-	-	-
Temperature (^{o}C)	20	-	-	-
Total Organic Carbon (mg/l)	7	-	-	-
Turbidity (Formazin Turbidity Units)	25	-	-	-
Total Phosphorus (mg/l) [h]	0.1	-	-	1.0 (Nov-Mar) 2.0 (May-June) 3.0 (Jul-Aug) 5.0 (Sept-Oct)
Total Inorganic Nitrogen (mg/l)	1.0* [f] -	- -	- -	- -

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a. NMWQCC, 1981. See also note f.
b. NMWQCC, 1980.
c. EPA, 1974; the New Mexico regulations also apply to the effluent.
d. These limits are proposed by EID and encompass both the State and Federal requirements; EID, 1981b.
e. The limit of 200 is no longer required by federal regulations.
f. () existing standard to be eliminated; * proposed standard to be added NMWQCC approved revision April 1981; State Attorney General and EPA approval expected late summer 1981.
g. See discussion in 6.6.2.
h. Refer to Appendix B.4 for discussion of proposed phosphorus effluent standard at Twining.

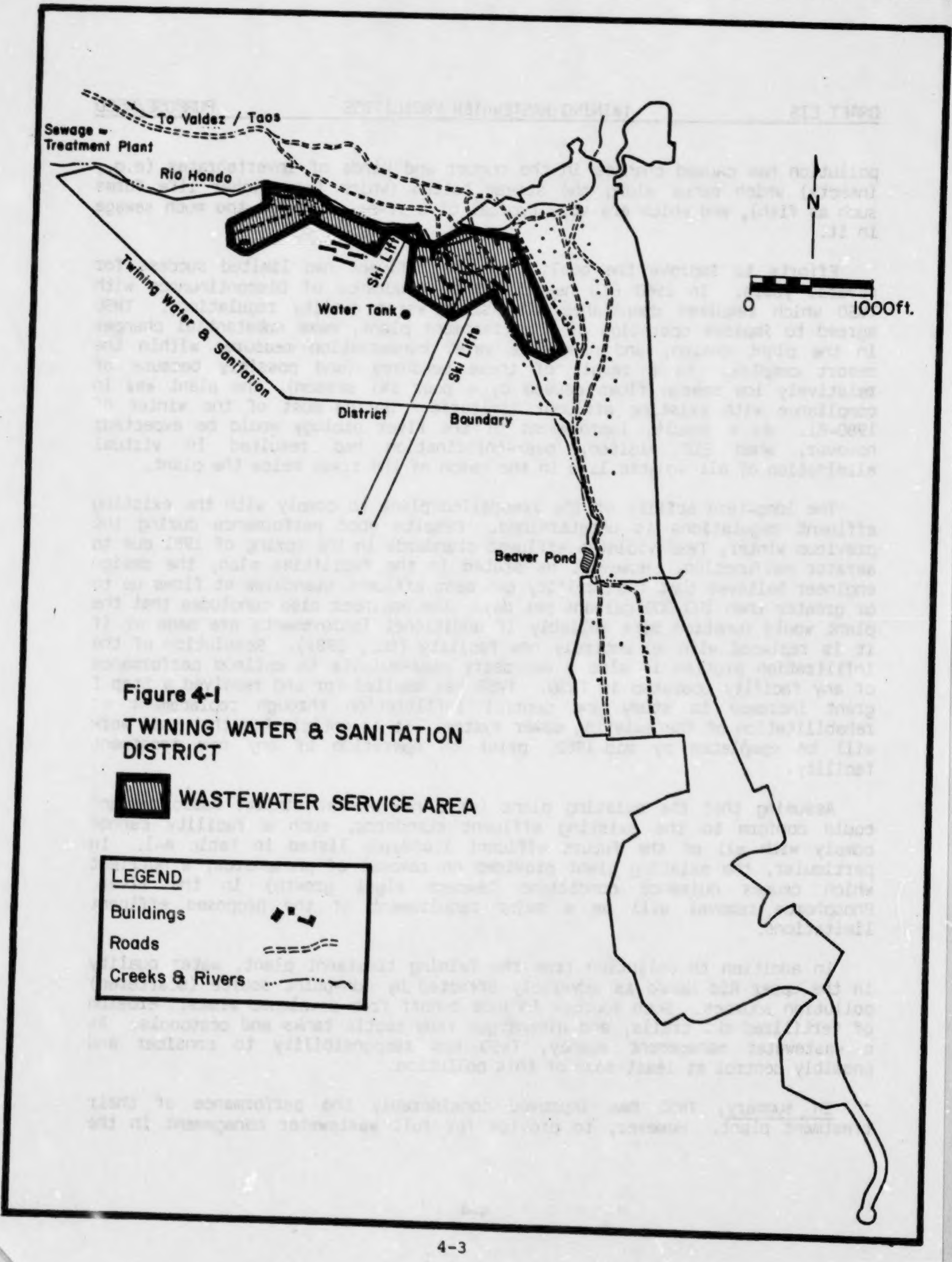

Figure 4-1
TWINING WATER & SANITATION DISTRICT

pollution has caused changes in the number and kinds of invertebrates (e.g., insects) which occur along the stream bottom (which feed higher life forms such as fish), and which are very typical of a river which has too much sewage in it.

Efforts to improve the quality of the effluent had limited success for several years. In 1980 EID negotiated an Assurance of Discontinuance with TWSD which required compliance with state water quality regulations. TWSD agreed to improve operation of the treatment plant, make substantial changes in the plant design, and undertake water conservation measures within the resort complex. As a result of these measures (and possibly because of relatively low sewage flows caused by a poor ski season), the plant was in compliance with existing effluent limitations during most of the winter of 1980-81. As a result, improvement of the river biology would be expected; however, when EID visited, over-chlorination had resulted in virtual elimination of all aquatic life in the reach of the river below the plant.

The long-term ability of the remodelled plant to comply with the existing effluent regulations is undetermined. Despite good performance during the previous winter, TWSD violated effluent standards in the spring of 1981 due to aerator malfunction. However, as stated in the facilities plan, the design engineer believes that the facility can meet effluent standards at flows up to or greater than 100,000 gallons per day. The engineer also concludes that the plant would function more reliably if additional improvements are made or if it is replaced with an entirely new facility (BLL, 1981). Resolution of the infiltration problem is also a necessary prerequisite to optimum performance of any facility operated in TWSD. TWSD has applied for and received a Step I grant increase to study and control infiltration through replacement or rehabilitation of the existing sewer system. It is anticipated that this work will be completed by mid-1982, prior to operation of any new treatment facility.

Assuming that the existing plant (or a new one of similar basic design) could conform to the existing effluent standards, such a facility cannot comply with all of the future effluent standards listed in Table 4-1. In particular, the existing plant provides no removal of phosphorus, a nutrient which causes nuisance conditions (excess algal growth) in the river. Phosphorus removal will be a major requirement of the proposed effluent limitations.

In addition to pollution from the Twining treatment plant, water quality in the upper Rio Hondo is adversely affected by non-point source (scattered) pollution sources. Such sources include runoff from developed areas, erosion of fertilized ski trails, and discharges from septic tanks and cesspools. As a wastewater management agency, TWSD has responsibility to consider and possibly control at least some of this pollution.

In summary, TWSD has improved considerably the performance of their treatment plant. However, to provide for full wastewater management in the upper Rio Hondo, and thus restore the river to an acceptable quality, there is a need to take further actions. These actions include: improvements to make the existing plant more efficient; upgrading of the facility to provide for phosphorus removal; and possible control of non-point source pollution. The significance of the pollution problem on the Rio Hondo is reflected by the fact that TWSD is second on New Mexico's priority list for receipt of construction grant funding.

For additional information on water pollution refer to chapter 6.2., 6.4 and Appendix B. Section 6.2.2 reviews the stream standards, and the history of water pollution in the upper Rio Hondo and evaluates the effects of non-point source pollution. Section 6.4.1 summarizes biologic impacts of the pollution. Appendix A discusses the existing regulations (part A.1), the history and nature of the existing facilities (part A.3), effluent quality from the plant (part A.3), and the history of management and enforcement (Part A.4). Details on the future requirements for phosphorus removal are discussed in the section on plant capacity alternatives (5.3).

Growth. TWSD intends that in upgrading the existing plant and providing for phosphorus removal there should be sufficient capacity to provide treatment of wastewater which would be generated by regulated and considered growth of the District (Stagg, 1981). The District's goal of a larger facility is not accepted by all area residents. In particular, groups representing downstream residents are generally opposed to further growth of the resort complex, and in particular oppose the construction of a larger wastewater treatment plant which would facilitate such growth.

The growth issue is complex and is discussed throughout this document. However, there are at least four major sub-issues which relate to decisions about the kind and size of any new facilities.

1. Protection of water quality is an unquestioned priority. In addition to strict and reliable conformance with the effluent limitations, any new facilities must be evaluated in terms of how well they benefit (or harm) water users throughout the Rio Hondo drainage.

2. Protection of water quantity is important, especially to downstream residents who rely upon the Rio Hondo as a source of irrigation and/or drinking water.

3. There is general interest throughout the region regarding the relationship between the capacity of a treatment plant, development in Twining, and impacts on the natural and socio-economic environment of the area.

4. The cost of new facilities is of concern, both to government agencies which may contribute funds toward the construction of the facilities and to District land owners and residents who are certain to experience increases in already high sewer rates.

In summary, there is a clear need for some improvements in wastewater management within TWSD, but different opinions exist as to the appropriate size (capacity) of any new treatment facilities. The 'best' solution as to plant size (as well as type of treatment process, location of plant, etc.) depends upon many factors, especially water quality, water quantity, regional environmental issues, and costs.

This limited discussion of issues will be expanded in the chapters which follow. Chapter 7 reviews all the major issues which have been raised regarding wastewater management in the Twining area.

4.2 PURPOSE OF EIS

The U.S. Environmental Protection Agency (EPA) determined that an Environmental Impact Statement (EIS) was necessary regarding any proposed or alternative wastewater facilities considered for Twining. The EPA decision was announced in a Notice of Intent dated August 20, 1979 and published in the Federal Register. The EIS has been prepared using the "piggyback" approach whereby the impact evaluation for EPA was completed by Lee Wilson and Associates, Inc., of Santa Fe, New Mexico, concurrently with preparation of the facilities plan.

This EIS is intended to provide essential information regarding the options available for treatment and reuse of wastewater, with particular reference to the issues outlined above and discussed in Chapter 7. The purpose of the information is to permit citizens and government officials to make an informed choice among the available alternatives, so that the decisions made will be of environmental benefit to the project area, the Twining region, and the nation as a whole. In evaluating alternatives, the technique of cost-effectiveness analysis is used. The analysis involves comparing all alternatives in a logical, objective, and systematic manner in order to identify relative merits and deficiencies. Where practical the comparisons are quantitative, and in some cases they involve the use of monetary values. The goal of the analysis is to identify the most cost-effective alternative, which is the option that:

-achieves all requirements mandated by federal, state and local laws and regulations, including environmental requirements; and

-does so with the minimum long-term cost to society; that is, with the most benefits and lowest attainable combination of dollar expenditures, environmental sacrifices and social burdens.

While quantitative and monetary terms are used in the analysis, cost-effectiveness is partly dependent upon qualitative considerations and subjective judgments. Consequently, the results of the analysis are neither absolute nor fixed.

CHAPTER 5

DESCRIPTION AND EVALUATION OF ALTERNATIVES

5. DESCRIPTION AND EVALUATION OF ALTERNATIVES

This chapter describes and evaluates alternative plans for controlling water pollution from the Twining Water and Sanitation District (TWSD). Alternatives considered by the District are presented in part A of the chapter. Alternatives available to the Environmental Protection Agency (including funding alternatives) are discussed in part B (see page 5-47). Decisions which might be made by the U.S. Forest Service, New Mexico Environmental Improvement Division and others are presented in part C (p. 5-48). In all cases the evaluation focuses on key issues which bear on the selection of the 'best' (most cost-effective) alternative. Technical details on these issues are presented (as necessary) in chapter 6.

PART A. ALTERNATIVES CONSIDERED BY THE APPLICANT

With the assistance of the Citizens Advisory Committee (CAC), TWSD evaluated a large number of alternatives for the collection and treatment of wastewater within District boundaries. One general alternative, that of taking no action, is discussed in section 5.1. Section 5.2 provides data on treatment alternatives and considers treatment processes, plant sites and potential wastewater reuse. Section 5.3 concerns the issue of plant capacity. Section 5.4 deals with the many other aspects of a wastewater management plan: construction of sewers (5.4.1); use and management of on-site systems such as septic tanks (5.4.2); determination of the specific plant site (5.4.3); sludge disposal and disinfection (5.4.4); energy conservation (5.4.5); flow reduction - water conservation (5.4.6); control of non-point source pollution (5.4.7); design of sewer rates (5.4.8); quality assurance (5.4.9); and other administrative matters (5.4.10). Of these alternatives, the subjects of quality assurance (guarantees of reliability) and rate design (equity; ability to generate sufficient funds) have received the greatest public attention.

Section 5.5 summarizes the preliminary decisions which have been made by TWSD and the CAC regarding the preferred alternatives. Supporting technical data related to various alternatives are presented in Appendix B.

5.1 NO-ACTION ALTERNATIVE

For reference purposes it is useful to consider what would happen if TWSD makes no improvements to the existing wastewater management system. As stated in chapter 4, the existing plant causes pollution of the Rio Hondo and violation of applicable standards. Failure to correct the problem could: 1) cause continued pollution of and environmental harm to the Rio Hondo; 2) place the District in jeopardy of enforcement actions, which could include large fines and court-imposed remedial actions; and 3) possibly lead to a court-mandated sewer hookup ban which could result in limits on growth within the District (or, alternatively, lead to widespread, uncontrolled growth using septic tanks and a proliferation of independent treatment plants). Collectively these effects would have a large, adverse impact on District land owners and downstream residents and would conflict with federal and state environmental regulations. Consequently the no-action Alternative is unacceptable. At a minimum, some actions must be taken to resolve the existing pollution problem and bring TWSD into compliance with future effluent standards.

It should be noted that comments on the no-action alternative have no bearing on the no-growth alternative (see section 5.3.) or on the no-funding alternative (see part B). Thus, for example, rejection of no-action does not imply either that EPA must fund a TWSD plant nor that TWSD must build a plant which provides more capacity than needed by existing development.

5.2 TREATMENT ALTERNATIVES (PROCESS, SITE)

Alternatives for treating Twining's sewage were developed to conform to the mandatory objective of meeting stream standards in the Rio Hondo. The main concern is that during low-flow periods the river cannot assimilate the nutrients now being discharged; this causes the stream to become "over-fertilized", resulting in adverse changes in the ecology of the river for several miles below the plant.

Many approaches can be considered as a means of providing nutrient control (along with conventional treatment). For example, consideration can be given to:

a. use of different treatment processes, including 'conventional' approaches which require a lot of chemicals and energy, and 'innovative' approaches which could be much more efficient, but which are not fully proven;

b. use of different locations for a treatment plant, including Twining, Valdez, Arroyo Hondo and Taos;

d. use of alternative discharge points, including the Rio Hondo, Rio Grande, Rio Pueblo (below Taos), as well as non-discharge alternatives including several types of sewage recycling (for farming, drinking, snowmaking).

Fifteen specific treatment alternatives were developed as part of the facilities planning process. Many additional variations and alternatives were discussed briefly at various public forums but were not judged to be feasible and are not discussed in this EIS. The fifteen alternatives were numbered sequentially as they were proposed. Table 5-1 provides a summary description of each alternative. Figure 5-1 illustrates how the alternatives are located with relationship to the Rio Hondo watershed. The table and figure illustrate

TABLE 5-1. DESCRIPTION OF TREATMENT ALTERNATIVES.

Unless otherwise noted for purposes of comparison, data given assume 95,000 gpd plant (with equalization basin to accept peak flows of 153,000 gpd), secondary treatment, and phosphorus removal.

Alternative Number, Name	Concept	Location of plant a/; discharge b/	Treatment technology c/	Nutrient removal approach d/	Comments; Problems
1. New Plant (conventional)	The existing treatment plant would be replaced by a new facility which would use conventional aeration processes for secondary treatment with chemical additives for removal of phosphorus. The specific proposal is for: 1. an entrance works to screen raw sewage; 2. an equalization basin; 3. four extended aeration chambers, uncovered, using diffused air (only one would be needed in summer); 4. a settling clarifier, with fiber glass cover; 5. a reactor clarifier for coagulation (with lime) and flocculation, with fiber glass cover; 6. dual-media pressure filters (using anthracite and sand); 7. recarbonation using carbon dioxide to lower the pH; 8. disinfection with ozone; 9. an aerated holding tank for the lime sludge; 10. greenhouse-covered sand drying beds for sludge. Items 6, 7 and 8, will all be within a building. Treated sewage would be discharged to the Rio Hondo.	Twining; discharge to Rio Hondo	advanced	biochemical	Complexity of plant is similar to that being operated today. Bypassing or storage of raw sewage would be necessary during construction of a new plant on the existing site.
2. Aquaculture	A greenhouse would cover a pond; the pond would simulate the conditions found in the natural environment and would use natural processes for treatment. Chemical treatment for phosphorus removal would still be necessary, as would ozone disinfection. The clean water would be discharged to the Rio Hondo.	Twining; discharge to Rio Hondo	advanced	biochemical	Process is unproven; a small-scale pilot plant would be essential prior to making a commitment to a full-scale operation. Option may be eligible for extra EPA funding and, if successful, would be a model for other areas of northern New Mexico.
3. Septic tanks	Replace the sewer lines and treatment plant with septic tanks. Large tanks would serve lodges and condominiums, small tanks would be used for Taos Ski Valley, and cabins. The treated sewage (still containing nutrients and some other impurities) would be discharged to ground water through drainfields.	Twining; discharge to soil	simple	soil	Necessary to determine the best types of septic tanks for use in Twining and study the effects of discharges on ground water and the Rio Hondo. District would need to consider active management of individual tanks. If another alternative is selected, the more remote parts of the District might continue to use septic tanks.
4. Composting toilets; greywater recycling	Each building or group of buildings would be served by its own composting toilets for treating blackwater (toilet wastes). Compost would be recycled. Greywater (kitchen, bath, laundry wastes) would continue to be treated at the existing treatment plant (which would be upgraded along the lines of Alternative 12, or perhaps less extensively). The treated greywater would be discharged to the river.	Twining; discharge to Rio Hondo	simple and advanced	biological	Composting toilets can be used as part of other alternatives. Existing buildings would need to be extensively remodeled. District would become legally responsible for the inspection and maintenance of every toilet in the District. Laundry wastes may need special handling, such as their own recycling unit.
5. Storage/discharge	Renovate the existing treatment plant, but do not provide a process for removing nutrients. Instead, use the sewage for snowmaking. The snow will runoff in spring, when the river flow is greatest, and the stream can absorb the nutrients without adverse impacts. During summer and fall, store the sewage in ponds and discharge it in amounts which are proportional to the stream flow.	Twining; discharge to Rio Hondo	standard	dilution	Many variations could be considered. Initial assumption is that ponds would store 60-days of sewage. Would require special provisions in NPDES permit.

TABLE 5-1. (continued).

Alternative Number, Name	Concept	Location of plant a/; discharge b/	Treatment technology c/	Nutrient removal approach d/	Comments; Problems
6. Total detention	Build a pipeline to the Arroyo Seco area and build 30 acres of ponds. The ponds would be sealed to prevent leaks, all the sewage would be evaporated. No water (or nutrients) would be discharged to the Rio Hondo. The existing plant in Twining could be used to provide some treatment of the sewage before it enters the pipe, to reduce odor problems in the pipe and ponds.	Twining; discharge to the air	simple	evaporation; landfill	Verious locations for the ponds could be considered. Ponds might provide aesthetic benefits; e.g. wildlife refuge. Potential for odors exists. No potential for agricultural re-use exists.
7. Land application	Similar to 6, except that only 5 acres of ponds would be built, and the pond water would be put into irrigation ditches during spring and summer, for use by the farmers in the Valdez area. The nutrients in the sewage would become a fertilizer to be reused in the soils and crops of the valley.	Twining; discharge to Arroyo Seco & Valley	simple	soil	See alternative 6. There would need to be a legal arrangement between Twining and the ditch associations. The type and feasibility of such an arrangement must be studied. EPA is very supportive of this type of alternative wherever there is a problem with nutrients in sewage.
8. Pipeline to Rio Grande	Renovate the existing treatment plant; build a pipeline from Twining to a point west of Arroyo Hondo; discharge the (nutrient-rich) treated sewage into the Rio Grande, which has enough flow to assimilate the sewage.	Twining; discharge W of Arroyo Hondo	standard	dilution	It might be possible to discharge into the Rio Hondo, a mile or two above the Rio Grande, and save a few miles of pipe. Would need BLM approval because the Rio Grande is a wild and scenic river; potential exists for conflict with recreational use at the Dunn Bridge (e.g., odors, solids, algae).
9. Holding tanks	Ponds built in Twining would store raw or partially treated sewage. Trucks (honey wagons) would haul the sewage to the Town of Taos treatment plant. Discharges from the Taos plant occur just above the Rio Grande, which has enough flow to assimilate small amounts of nutrients.	Taos; discharge to Rio Pueblo	standard	dilution	Ponds might be covered and put underneath pro-proposed new parking lots. Potential for high energy costs (gasoline) and traffic impacts (safety, emissions, spills).
10. Hondo Valley plant	Build a new regional treatment plant near Arroyo Hondo, which would discharge sewage to the Rio Grande. Twining would build a pipeline to the new plant and be one of many potential users.	Arroyo Hondo; W. of Arroyo Hondo	standard	dilution	Costs in Appendix C are for Twining portion of facilities only. Different locations for a plant could be considered.
11. Taos regional plant	Similar to 10, except the pipeline would go through Arroyo Seco and El Prado, and eventually to the Town of Taos treatment plant, which would be expanded.	Taos; discharge to Rio Pueblo	standard	dilution	Costs in Appendix C are for Twining portion of facilities only.
12. Rehabilitate existing plant	The existing treatment plant would be rehabilitated to improve its performance, and phosphorus treatment would be added. Major changes would include: 1. addition of covered equalization basins; 2. repair and covering of the existing aeration basin; 3. addition of sludge removal in the existing clarifier; 4. covering of existing aerobic digester; 5. addition of sludge dewatering; 6. addition of phosphorus removal by chemical addition (lime) and sand filters; 7. disinfection by ozone; and 8. general reconstruction of the piping at the plant. Treated sewage would be discharged to the Rio Hondo.	Twining; discharge to Rio Hondo	advanced	biochemical	Compared to Alternative 1 the 'add-on' nature of the plant would lead to a greater potential for periodic breakdowns and possible failures to meet effluent standards. For example, it would be less flexible in dealing with the relative low flows experienced in summer. Some solution must be selected for taking care of the sewage during the period when the existing plant is being rehabilitated, and is therefore out of service.

TABLE 5-1. (continued).

Alternative Number, Name	Concept	Location of plant a/ discharge b	Treatment technology c/	Nutrient removal approach d/	Comments; Problems
13. Total recycling	Alternative 1 would be modified and combined with additional facilities to purify sewage to meet drinking-water standards. There would be greater use of lime by the advanced plant, plus the following additional steps: recarbonation (to adjust for the greater use of lime), two granular carbon filters separated by ozonation; reverse osmosis to remove salts; and final disinfection by ultraviolet radiation. The entire water system of Twining would be revamped to eliminate bypassing of flows; thus, 100% of the sewage would go into the water system.	Twining; none	advanced	biochemical	Very difficult to implement under present EPA and EID regulations and policy. Complexity of this approach is such that for reliability reasons it is banned in California. An environmentally acceptable variation of this alternative would be to discharge the reclaimed water to the Rio Hondo. This approach, 'total treatment', accomplishes most of the benefits of total recycling without the immediate viral hazard.
14. Blackwater recycling; total detention of greywater	Combines alternatives 4 and 6. Each building or group of buildings would be served by its own composting toilets for treating blackwater (toilet wastes). The compost would be recycled. Greywater (kitchen, bath, laundry wastes) would be disposed of through a pipeline to the Arroyo Seco area, and evaporation in about 18 acres of ponds. The ponds would be sealed to prevent leaks; all the sewage would be evaporated. No water (or nutrients) would be discharged to the Rio Hondo. The existing plant in Twining could be used to provide some treatment of the sewage before it enters the pipe, to reduce odor problems in the pipe and ponds.	Twining; discharge to Arroyo Seco	simple and advanced	biological + evaporation	Combines Alternatives 4 and 6; would require 18 acres of ponds.
15. Aquaculture +	Aquaculture (or any of the other alternatives) would be used in conjunction with snowmaking in order to provide the treatment benefits of the former and the water supply benefits of the latter.	Twining; discharge to Rio Hondo	advanced	biochemical + dilution	Combines Alternatives 2 and 5; 5 could be added to other alternatives as well

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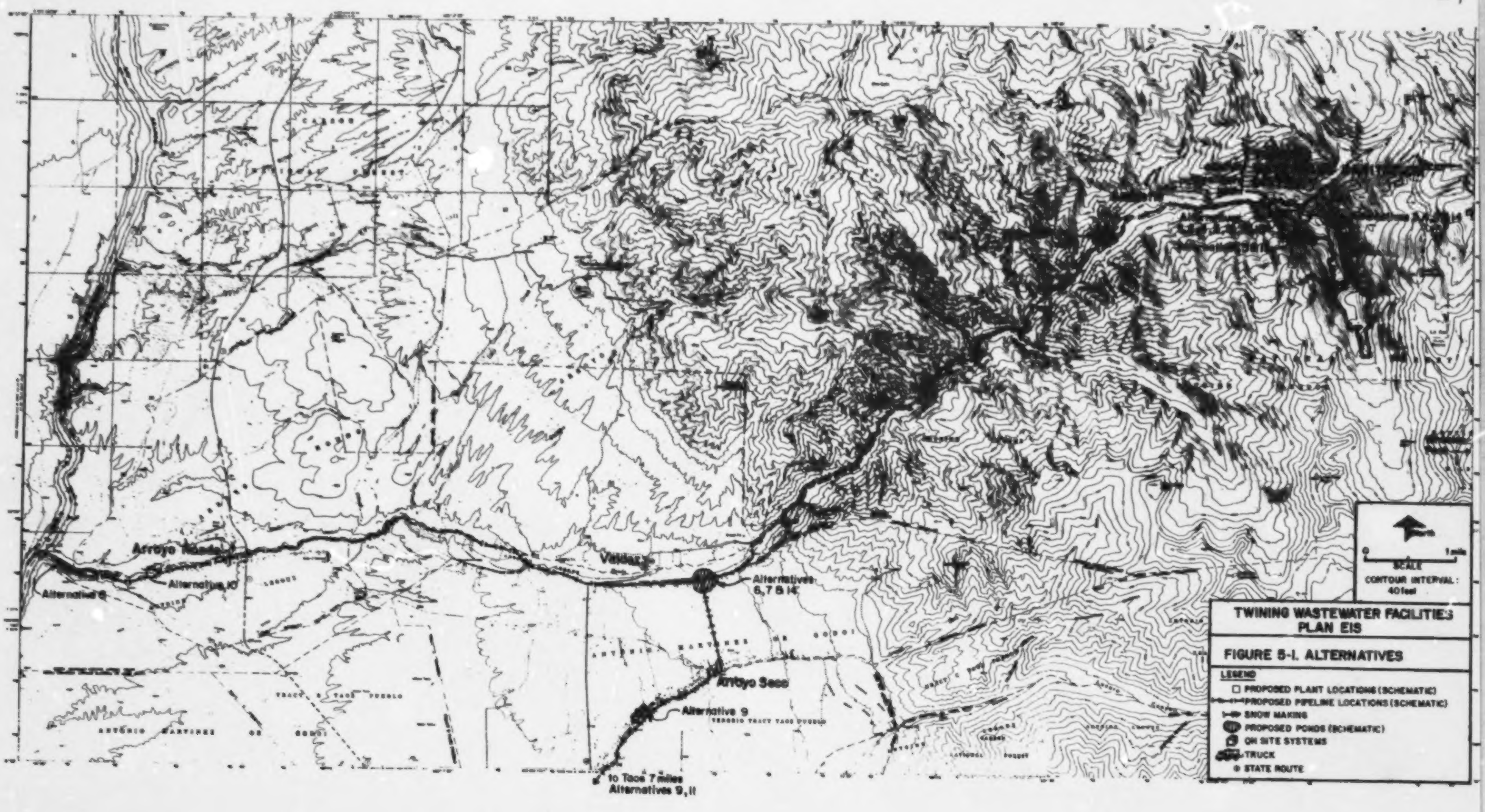
a. location of plant: site where the major treatment of wastes takes place.
b. location of discharge: site where water leaves control of Sanitation District.
c. treatment technology: advanced = technology which requires use of biological and chemical processes which are not in common use in New Mexico; standard = technology similar to that which now exists in Twining and Taos; simple = technology which is very basic, and by itself not adequate to treat sewage to the quality demanded by the standards.
d. nutrient removal approach: biochemical = removed by the treatment plant; soil = nutrients removed as sewage passes through soil (for land application, this includes uptake by crops); evaporation = sewage is evaporated, nutrients concentrate in remaining water, and are never discharged; dilution = nutrients are discharged to a river which has enough flow to dilute the nutrients to relatively harmless levels.



TWINING WASTEWATER FACILITIES PLAN EIS

FIGURE 5-1. ALTERNATIVES

that the alternatives take many different approaches to the control of pollution in the Rio Hondo, in line with the concepts noted above.

Appendix B of this EIS contains information of special importance to evaluation of the alternatives. Appendix B.1 discusses an important change in the treatment objectives which occured during the planning period, and which altered the perspective on cost-effectiveness. Appendix B.2 discusses the role of equalization basins as a factor determining the relationship between total sewage flow and actual plant capacity. Appendix B.3 provides cost data on each of the fifteen alternatives. Additional technical information is contained in the draft facilities plan.

The evaluation of the alternatives involved two major steps both of which are documented in this EIS rather than in the facilities plan.

> First, as described in section 5.2.1, all fifteen options were assessed in a general way. Five were considered deserving of more detailed study.
>
> Second, as described in section 5.2.2, the remaining five alternatives (plus a revised version of one of the others) were then assessed in somewhat greater detail.

In both steps the evaluation process involved the rating of the alternatives according to various economic and environmental issues. Table 5-2 summarizes the issues which were used in the ratings. These issues were selected in order to concentrate on major differences among the alternatives.

5.2.1 Initial Evaluation

Table 5-3 provides a brief description of each alternative and lists a few of the strong and weak points of each option. The table also contains generalized ratings or rankings for the alternatives according to their performance with regard to eight of the issues. (Issues marked ** in Table 5-2 were not used.) Table 5-3 provides three rating categories: for each issue a rating of 1 was given for alternatives which had the least adverse impact (best characteristics); a rating of 2 was assigned to those with intermediate effects; and a rating of 3 was used to indicate alternatives with the greatest adverse impact. For example, the first rating in Table 5-3 reflects the cost of the alternatives. The number 3 is assigned to the most expensive alternatives; 2 means an alternative is less expensive; and the number 1 indicates a relatively low-cost option.

Briefly, the basis of the other seven ratings was as follows (see Table 5-2).

> Reliability: the best ratings identify alternatives which would be easiest to operate.
>
> Water quality: some alternatives may actually fail to meet the mandatory pollution standards and are rated 3 (in this case indicating the

TABLE 5-2. ISSUES USED TO EVALUATE TREATMENT ALTERNATIVES.

These issues were selected to focus on differences among alternatives. Issues without an asterisk were used to evaluate the initial fifteen treatment alternatives issues marked with one asterisk (*) were used to rate both the fifteen initial and six semi-final alternatives. A double asterisk (**) identifies issues used to rate the six semifinal alternatives only.

ISSUE	CONCEPT	Specific Ratings/Comments
Total Costs	20-year costs to construct and operate facility. See Appendix B.3 for actual cost data, assumptions. For Table 5-3, initial ratings discussed at public meetings have been adjusted to reflect change in treatment objectives, which are likely to mandate phosphorus but not nitrogen removal (see Appendix B.1).	1= generally cost less than $150,000 per year 2= $150,000 - $300,000/year 3= cost more than $300,000/year
Impact on Rates**	Reflects costs borne by TWSD, assuming that some of construction costs and none of operations costs are paid by federal and state grants. Impacts on rates increase with higher total costs and with higher relative proportion of operational costs. (Thus if two alternatives have similar dollar costs, but one has high energy costs it has a greater impact on rates.)	1= low total costs and low operational cost 2= low total costs and intermediate operational costs 3= low total costs and higher operational costs 4= high dollar costs and intermediate operational costs 5= high dollar costs and high operational costs 0= costs borne by Taos Ski Valley, Inc.
Reliability*	Based primarily upon the facilities plan engineers judgment as to the level of effort needed to ensure continued good performance of an alternative. With increasing complexity of operation there is more potential for operational failures, resulting in odors, water pollution or other problems. In general any innovative alternative has unproven aspects and is given a higher rating than conventional alternatives. For Table 5-3, initial ratings discussed at public meetings have been adjusted to reflect proposed deletion of nitrogen treatment processes.	for 15 alternatives: 1= minimal complexity (simple technology) 2= involve long pipelines with treated sewage; and/or intermediate technology 3= involve complex plant inherently difficult to operate; and/or involve long pipeline with raw sewage (significant odor potential at pump stations) for six semifinal alternatives: 1= most reliable of the five treatment alternatives 5= least reliable of the five treatment alternatives (snowmaking is rated 2 because its complexity is judged similar to alt. 12)
Water Quality*	Based on impact to Rio Hondo, primarily as measured by state Stream Standards. Alternatives which minimize or avoid pollutant discharge to the river are rated favorably as they go beyond requirement of stream standards.	for 15 alternatives: 1 = no effluent discharged to Rio Hondo, thus no adverse impact on stream quality 2 = meets stream standards 3 = may not meet stream standards for six semifinal alternatives: 1 = least impact on Rio Hondo of the five treatment alternatives 3 = most impact on Rio Hondo (standards will be met) (see text for discussion of snowmaking)
Water Supply *	Alternatives which solve the pollution problem by eliminating all discharges to the Rio Hondo are generally rated unfavorably. No longer would this water be part of the flow of the river in the Valdez-Arroyo Hondo areas. To compensate for the loss of flow, Twining would need to acquire water rights along the Hondo. This would probably involve purchase and retirement of agricultural land. Depending on the alternative, 30-50 acre-feet of water rights would be needed. Loss of water rights would affect the economy and lifestyle of the Hondo Valley, as about 1% of the farmland along the river would be retired. Alternatives which involve recycling may benefit water supply and are rated favorably.	for 15 alternatives: 1 = involve recycling (turn wastewater from a liability to an asset) 2 = continue existing practices 3 = would require Twining to acquire water rights (total detention, alternative 6, has greatest impact since 100% of the wastewater would be evaporated and never put to beneficial use; other options rated 3 - alternatives 8 to 11 - would allow people downstream - Pilar, Velarde, Albuquerque, etc. - to eventually use the wastewater, even though the resource would no longer be part of the water resources of the Hondo watershed. for six semifinal alternatives: see text

TABLE 5-2. ISSUES USED TO EVALUATE TREATMENT ALTERNATIVES, CONTINUED.

ISSUE	CONCEPT	Specific Ratings/Comments
Downstream Land Use	Regional pipelines may permit high-density development in downstream areas. See text.	3 = could open up downstream areas to urban development. 2 = no downstream impact 1 = used for alternative 3 because it might tend to result in relatively low-density development in Twining itself. In particular, this option (septic tanks) would tend to cause a spread-out type of development, rather than intensive use of the base area.
Resort Expansion **	Ability to provide long-term wastewater management in event that growth occurs in Twining area. See text.	1 = most easily expanded of the five treatment alternatives 5 = least flexible if growth occurs (most likely to fail if expanded)
Community Conflicts	Reflects potential conflicts between Twining and those who live downstream. Major conflicts could occur from alternatives which involve a ponding area or treatment plant which is located downstream (the relocation of sewage facilities almost always leads to some controversy, e.g. due to odor potential). Similarly, pipelines through downstream areas could pose special operational problems - such as odors and leaks - which could lead to complaints from people who live near the pipelines. Pipes which carry sewage which has undergone only minimal treatment would be of most concern. A special problem would occur for alternatives which would require downstream people to join in a legal arrangement involving Twining; the historical conflicts between Twining and downstream residents suggest difficulty in establishing and implementing such an arrangement. Alternative 9 would produce a great deal of road traffic, especially in winter, which would be of concern to those using the Arroyo Seco road.	1 = may not cause any of these particular conflicts 2 = have one potential type of conflict 3 = have the potential to cause two or more of these conflicts
Benefits to Region	Some alternatives may have benefits beyond solution of the sewage problems of Twining. These may include: a) creation of a regional sewer system (assuming that such a system is needed to protect ground water quality and public health, and ignoring adverse effects as described under regional land use); b) use of wastewater ponds to provide a regional recreation site; c) successful demonstration of innovative technology, such as aquaculture, which might benefit mountain communities throughout Northern New Mexico.	1 = provide regional sewer system 2 = provide other benefits 3 = no special regional benefits
Construction Impacts*	Alternatives which involve major construction down the Hondo Canyon are likely to have much greater impact than alternatives which put all facilities in Twining. Putting a pipeline along the existing road would have impacts such as: erosion; disruption of traffic; noise. Right-of-ways (mostly from the Highway Department and the Forest Service) would be required. Additional (but similar) impacts would occur if the alternative also involves building of a new treatment plant in a downstream area, or the construction of ponds for the storage of sewage. Also, the land used would itself be taken out of production forever.	for 15 alternatives: 1 = involve only construction within Twining 2 = require a pipeline, but no new plant 3 = involve a pipeline and a new treatment plant (or ponding areas downstream) for six semifinal alternatives: see text

TABLE 5-3. EVALUATION OF FIFTEEN TREATMENT ALTERNATIVES.

ISSUES are identified by letter, as follows. A = Cost. B = Reliability. C = Water quality. D = Water supply. E = Construction impacts. F = Land use (growth). G = Community conflict. H = Benefits to region. See Table 5-2 for explanation of issues.

Name of alternative	Brief description of alternative	Ratings on ISSUES a/								Pros = reasons which might lead some people to favor an alternative. Cons = reasons which might lead some people to reject an alternative.
		A	B	C	D	E	F	G	H	
1. Conventional new plant	Build new plant in Twining using advanced technology which needs energy, chemicals	1	2	2	2	1	2	1	3	Pros: "conventional" approach Cons: energy use; complex operation
2. Aquaculture	Build new plant in Twining using new technology which grows algae in ponds inside a greenhouse	1	2	2	2	1	2	1	2	Pros: very progressive in its use of resources; comparatively inexpensive Cons: too new an idea to know how well it will work
3. Septic tanks	Abandon the sewer system; everyone uses septic tanks	1	1	3	2	1	1	1	3	Pros: "conventional" approach; inexpensive; simple Cons: will not solve the pollution problem
4. Greywater/ blackwater	Some sewage goes to existing (renovated) plant; toilet wastes to composting toilets	2	3	2	2	1	2	1	3	Pros: very progressive in its use of resources Cons: expensive; reliability uncertain
5. Storage and discharge	Store the winter sewage and discharge it in spring when river can better assimilate nutrients	1	2	3	1	1	2	1	3	Pros: may improve downstream water supplies in terms of quantity; inexpensive Cons: may not solve pollution problem
6. Total detention	Pipe sewage to ponds near Arroyo Seco and evaporate it	3	1	1	3	3	2	2	2	Pros: simple; takes Twining sewage out of Rio Hondo Cons: expensive; wasteful of water; water rights would be needed
7. Land application (farming)	Pipe sewage to ponds near Arroyo Seco and let farmers use it for irrigation	2	2	2	1	3	2	3	2	Pros: supports farming; not too expensive Cons: requires agreement of farmers, and some type of legal arrangement with Twining
8. Pipeline to Rio Grande	Renovate existing Twining plant; build pipeline to Rio Grande (west of Arroyo Hondo) and discharge sewage there	2	2	1	3	2	2	2	3	Pros: takes Twining sewage out of Rio Hondo Cons: water rights would be needed; major construction impacts
9. Holding tanks	Store sewage in ponds in Twining and use trucks to haul it to the Town of Taos sewage plant	1	2	1	3	1	2	2	3	Pros: simple, relatively inexpensive; eliminates pollution in Rio Hondo Cons: uses energy; heavy truck traffic; water rights would be needed
10. Regional plant in Hondo Valley	Pipe sewage to a new regional sewage plant near Arroyo Hondo	2	3	1	3	3	3	3	1	Pros: eliminates pollution in Rio Hondo; could provide sewers for downstream residents Cons: major land use changes could occur in Hondo Valley; major construction impacts; water rights would be needed
11. Regional plant in Taos	Pipe sewage to Town of Taos sewage plant	2	3	1	3	2	3	3	1	Pros: takes Twining sewage out of Rio Hondo; could provide sewers for Arroyo Seco-El Prado area Cons: major land use changes could occur near Taos; major construction impacts; water rights would be needed
12. Rehabilitation	Renovate existing plant and add on advanced processes for nutrient removal	1	3	2	2	1	2	1	3	Pros: "conventional"; relatively inexensive Cons: reliability is questionable
13. Total treatment	Build very complex plant in Twining which would turn sewage into drinking water for use by Twining	3	3	1	2	1	2	1	3	Pros: takes Twining sewage out of Rio Hondo, without adverse effects on flows Cons: extensive energy and chemical use; very expensive; against federal, state regulations
14. Greywater evaporation	Combine alternatives 4 and 6: compost toilets, greywater evaporation	3	3	1	3	3	2	2	2	Pros: simple; takes Twining sewage out of Rio Hondo Cons: expensive; reliability uncertain; wasteful of water; water rights would be needed
15. Aquaculture + snowmaking	Combine alternatives 2 and 5	2	2	3	1	1	2	1	2	Pros: progressive in use of resources; would increase spring and summer runoff Cons: some questions about reliability; may not solve pollution problems

a. 1 = less impact (best rating); 2 = intermediate impact; 3 = more impact.

alternative should be rejected); others would clean up the Rio Hondo beyond the standards and are rated 1. A rating of 2 indicates standards would be met.

Water supply: alternatives rated 3 would require the retirement of irrigated lands and the transfer of as much as 50 acre-feet/year water rights; those rated 1 provide special wastewater recycling benefits.

Construction impacts: adverse (higher) ratings occur for alternatives involving major construction outside of the Twining area (such as construction of a pipeline through the Hondo Valley and/or construction of treatment facilities in the Arroyo Seco area).

Land-use impacts: a rating of 3 is assigned to alternatives which could lead to urban-level growth in rural areas - along the lower Rio Hondo (alternative 10) or along the Arroyo Seco highway (alternative 11).

Community conflicts: a rating of 3 or 2 (high potential for conflict) is given if the Sanitation District would have facilities in downstream areas.

Regional benefits: the best ratings (1) reflect alternatives which could benefit citizens other than those living in TWSD.

The implications of Table 5-3 can be summarized by grouping the alternatives into four categories: use of on-site systems; conventional plants; innovative alternatives; and regional solutions.

On-Site Systems would treat Twining wastewater without the need to use a central treatment plant. Alternative 3 (Table 5-1) is the main example of such an option. This option would use septic tanks and drainfields for wastewater discharge, a practice which normally accomplishes extensive phosphorus removal. However, Table 5-3 shows a water-quality rating of 3 (unacceptable) for this alternative. The rating reflects soil conditions in Twining which are not conducive to phosphorus retention and evidence that on-site systems contribute significantly to pollution of the Rio Hondo. Widespread use of septic tanks in TWSD probably would lead to violation of stream standards for phosphorus (and perhaps other parameters such as bacteria).

Rejection of alternative 3 does not preclude limited use of on-site systems such as septic tanks, as for example in remote parts of the District where construction of sewers would be especially difficult.

Alternatives 4, 9 and 14 involve some use of on-site systems. However their primary emphasis is on innovative technology (4, 14) or regional disposal (9); they are discussed subsequently.

Conventional alternatives would provide standard secondary treatment and phosphorus control at a facility in the Twining area; treated effluent would be discharged to the Rio Hondo. As illustrated in Table 5-1 they approach the nutrient control problem through biochemical treatment processes and dilution. The two choices involve rehabilitation of the existing plant (alternative 12) or construction of an entirely new conventional facility (alternative 1). As suggested in Table 5-3, these approaches generally have less adverse effects than many other alternatives. Factors which are less beneficial than from some other options include: complexity (which could adversely affect reliability); high operational costs (especially for energy); and the fact that there would still be some effluent discharged to the Rio Hondo (that is, there would not be a 100% clean-up of the river).

Innovative alternatives all involve some unusual approach to wastewater management through special facilities built in the Twining area. These approaches are of three types. First, there are two alternatives which would take care of toilet wastes through the use of composting toilets. These are alternatives 4 (which would treat non-toilet wastes in a conventional plant) and 14 (which would evaporate the non-toilet wastes). Second, two alternatives involve special treatment and recycling of the wastewater. These options are alternative 5 (which uses wastewater for snowmaking) and 13 (total treatment of sewage to produce drinking water). Third, there are two aquaculture alternatives which would treat sewage by using it to grow algae in solar-heated ponds. These are alternatives 2 and 15 (the latter is number 2 with a snowmaking option added on).

In Table 5-3 the innovative options generally have a poor rating for reliability because of uncertainty as to whether or not they will work as intended. This is of special concern considering the long history of pollution in the Rio Hondo and the interests of all concerned to see the river protected. Also, some of the innovative alternatives are quite expensive. A special problem of alternatives 5 and 15 is that snowmaking does not necessarily provide any phosphorus removal and may not meet the water quality mandate faced by Twining. This is reflected by a water-quality rating of 3.

Regional alternatives would solve Twining's problems by using wastewater facilities in other areas of Taos County. Nutrients would not be removed from the sewage, but rather the nutrient-rich wastewater would be discharged to a river which has enough flow to assimilate the nutrients without becoming overburdened with algae.

There are four alternatives which involve 'export' of the sewage to the Rio Grande or to Taos. Three of these involve big pipelines. Alternative 8 would pipe all of Twining's treated sewage along the Hondo Valley and discharge it directly to the Rio Grande. Alternative 10 would build a regional sewage plant in Arroyo Hondo to serve both Twining and other communities in the area. Alternative 11 would pipe Twining's sewage to the Town of Taos treatment plant, west of Ranchitos. Alternative 9 would not use a pipeline; instead, trucks would take sewage from Twining to the Town of Taos treatment plant.

Two regional alternatives would dispose of the wastewater in the Valdez-Arroyo Seco area. Alternative 6 would evaporate the sewage in ponds built near Arroyo Seco. Alternative 7 would provide treated wastewater to farmers in the Valdez area.

The ratings in Table 5-3 highlight three major drawbacks to the regional alternatives. First, these choices are generally expensive, even when compared to some of the innovative alternatives. Second, except for the land application option (7) they all would reduce stream flows in the Rio Hondo because the treated effluent would no longer be part of the river water. Under New Mexico law, TWSD would have to obtain and retire irrigated lands along the lower Rio Hondo in order to offset the change in flow; this impact at the scale required produced a very negative response from the public. Third, all of the regional options have the effect of bringing TWSD's wastewater management problems out of the mountains and into the settled part of the Taos Region.

In addition, alternatives 10 and 11 would open up the possibility that sewers would be available in downstream areas. The availability of sewers could have a profound effect on land use. In general, the key to controlling land use is zoning, and/or subdivision regulations. Where such controls are strong, the availability of sewers does not necessarily change land use. Where zoning is not strong (as is the case in Taos County at present) sewers allow high-density residential and commercial development which otherwise would occur to a much more limited extent. Put another way, high-density development is difficult to accomplish using septic tanks, but easier to do once sewers are in. Sewers do not force a community to accept a high-density type of development. But they do allow such development to occur, unless there are strong zoning controls.

Residents of Taos County are familiar with this problem through the history of a high-density condominium development between Taos and Arroyo Seco, known as the Tennis Ranch. This project had significant problems obtaining state approval of its self-contained sewage system. Such problems would be expected to have an impact on future developments of the same type - an obstacle which could increase the costs of development significantly. With a sewer line in place down the Hondo Valley or along the Arroyo Seco highway, such problems virtually disappear, and sewage disposal would no longer be an obstacle to development. Unless a strong county zoning policy were adopted, the sewer line could change development patterns in the Taos area. One result would be a change of land from rural to urban use, and a loss of the agrarian lifestyle of the affected area.

After the implications of the regional alternatives were discussed at public meetings, citizen testimony strongly and consistently opposed all such options.

Screening of Alternatives. The ratings given in Table 5-3 allow ten of the alternatives to be screened out.

Alternatives 3, 5 and 15 have unacceptable water quality effects and must be rejected.

The principals of cost-effectiveness analysis explained on p. 4-6 rule out any of the very expensive options which have no major compensating benefits. This leads to rejection of alternatives 6 and 14; alternative 13 is not immediately ruled out because of its special water quality benefits.

Four of the regional alternatives received no public support and extensive public criticism because of water rights impacts, potential for community conflict and in some cases, potential effects on land use. All are expensive, have no benefits sufficient to make them cost-effective, and were screened out as a direct result of the public participation process. The alternatives are: 8 (pipeline to Rio Grande); 9 (holding tanks); 10 (Hondo Valley regional plant); and 11 (use of Taos regional plant).

Alternative 7 has more benefits and less adverse impacts than the other regional alternatives. However its success requires cooperation between TWSD and downstream farmers on a day to day basis; this cannot be assured. Citizen opposition to this alternative indicates it cannot be implemented effectively and should be screened out.

One implication of the initial screening was to emphasize the importance of water supply as a key public issue. Although all citizens desire the Rio Hondo to be as clean as possible, public input generally supported continued discharge of treated wastewater to the Rio Hondo rather than alternatives which would put the wastewater elsewhere and which would require retirement of water rights.

5.2.2 Follow-up Evaluation

Based on the initial screening, five alternatives remained for further consideration. For purposes of evaluation, the alternatives can be grouped into two categories.

Conventional Alternatives: either a new treatment plant (alternative 1) or rehabilitation of the existing plant (alternative 12). In both cases treatment would involve secondary treatment plus phosphorus removal.

Innovative Alternatives: aquaculture plus phosphorus removal (alternative 2); or composting toilets and conventional treatment of kitchen/bath water (alternative 4); or total treatment to produce and recycle or discharge drinking water (alternative 13).

In addition, one of the rejected alternatives was revised and reconsidered.

Add-On Alternative: use treated wastewater for purposes of snowmaking. This differs from initial alternatives 5 and 15 in that snowmaking is not considered as a treatment method, but as a means of wastewater disposal/ recycling that would be added on to one of the above alternatives. It can be labeled alternative 15A.

In the public participation process these six options were termed the 'semifinal' alternatives (see chapter 7 for discussion of this process). Six of the issues listed in Table 5-2 (those marked * or **) were used to evaluate the semifinal alternatives. These issues are: impacts on rates; reliability; impacts on water quality; impacts on water supply; construction impacts; and potential for expansion. The results of the ratings are given in Table 5-4; the table also highlights the major pros and cons of each alternative and provides data on the dollar costs of the alternatives. The rating system was similar to that used in the initial evaluation, except that the numbers extended from 1 to 5 (5 = worst). The basis for the ratings on each of the six issues is explained below.

Rates. The dollar costs of the alternatives will have a direct impact on land owners, residents and visitors in TWSD. In general, the rankings given in Table 5-4 parallel total annual dollar costs: the most expensive alternatives have the greatest impact on rates. In the special case of snowmaking, it is presumed that the ski corporation would pay all of the District's share of costs for this alternative through some sort of contractual relationship; the rating of 0 reflects the fact that the costs of snowmaking should not show up in District rates.

Reliability. As in Table 5-3, ratings reflect complexity of operation. Total treatment is banned in California because of concerns over reliability; a rating of 5 is warranted. Maintaining composting toilets throughout the District is a special headache of the greywater alternative; hence, the rating of 4. The rating of 3 for aquaculture reflects the risks inherent in undertaking any innovative alternative. Alternative 12 is considered slightly less reliable (less flexible) than alternative 1 because the former must make use of existing facilities which are not in optimum condition. This is a special liability because of the substantial fluctuation of inflows; for example, alternative 12 could experience operational problems during low-flow (summer) periods.

Water quality. The five treatment alternatives all meet the mandatory requirement to protect the Rio Hondo against pollution. Variations in ratings regarding water quality reflect relatively small differences in the amount of water clean-up beyond the stream standards. Three of the alternatives (1, 12, 15) would exactly conform to standards and are rated 3. (However, it is possible that alternatives 1 and 15 would perform better than alternative 12.) Alternative 13 is ranked as the best of the choices (rating = 1) because it would completely eliminate all pollutant discharges to the Rio Hondo. The composting toilets/greywater alternative also goes beyond stream standards (although less so than alternative 13). This approach eliminates water-borne toilet wastes from the discharge to the river; only kitchen, bath and laundry wastes remain to be treated and discharged. The water-quality aspects of snowmaking are complex and are examined in section 6.2.6. The analysis indicates that this alternative would probably cause violations of the stream standards; therefore it is rated 5.

TABLE 5-4. EVALUATION OF SIX 'SEMIFINAL' ALTERNATIVES

Total annual cost = sum of construction (mortgage) and operating costs for a 95,000 gpd plant (maximum allowed by regulations), in 1980 dollars. (In parentheses are costs for an 80,000 gpd plant, which is just large enough to accommodate existing development). Issues are identified by letter, as follows: A = Rates; B = Reliability; C = Water quality; D = Water supply; E = Construction impacts; F = Expansion potential. See Table 5-2 for explanation of issues.

Number and name of alternative	Brief description of alternative	Total Annual Cost a/	Ratings on ISSUES b/						Possible reasons for selecting or not selecting the alternative. Pros = reasons which might lead to selection of an alternative. Cons = reasons which might lead to rejection of an alternative.
			A	B	C	D	E	F	
1. Conventional new plant	Build new plant in Twining using advanced technology which needs energy, chemicals	$175,360 ($155,324)	3	1	3	3	1	4	Pros: "conventional" approach; most reliable Cons: more expensive than #12 Other: preferred by engineer
12. Rehabilitation	Renovate existing plant and add on advanced processes for phosphorus removal	$133,846 ($120,867)	2	2	3	3	2	5	Pros: "conventional"; relatively inexpensive Cons: reliability is less than a new plant Other: salvages some of the past investment
2. Aquaculture	Build new plant in Twining using new technology which grows algae in ponds inside a greenhouse	$108,172 ($98,748)	1	3	3	3	1	3	Pros: progressive in its use of resources; least impact on user charges Cons: reliability and 'energy efficiency' are unproven Other: possibly could be demonstration plant for area
4. Compost toilets/ greywater treatment	Some sewage goes to existing (renovated) plant; toilet wastes to special systems capable of recycling	$254,967 ($192,200)	5	4	2	1	5	2	Pros: progressive in its use of resources Cons: expensive; reliability uncertain Other: might not gain EPA approval
13. Total recycling	Build very complex plant in Twining which would turn sewage into drinking-quality water	$338,195 ($270,833)	5	5	1	3	1	1 c/	Pros: eliminates sewage from Rio Hondo, without adverse effects on flows Cons: extensive energy and chemical use; very expensive; reliability is very questionable Other: very unlikely to gain EPA or EID approval
15A. Snowmaking	Use wastewater for snowmaking	$53,679 ($40,526)	0	2	5	4	3	3	Pros: puts wastewater to a positive use Cons: adverse impacts on water quality Other: can occur using river water

a. Does not include engineering costs, legal fees, contingencies, sewer rehabilitation, or existing debt.
b. The alternatives are each rated from 1 (least impact, best rating) to 5 (most impact, worst rating) with reference to six basic issues.
c. Rating assumes discharge of effluent to Rio Hondo, not recycling to water system.

Water supply. In general, the alternatives have little direct effect on flow in the Rio Hondo; that is, effluent would continue to be discharged to the river and would be used as an irrigation water supply downstream. An exception is alternative 4 - the composting toilet/greywater option - which would reduce water use in Twining. A rating of 1 is justified for this alternative. The water-supply effects of total recycling and snowmaking are relatively complex and are analyzed in section 6.2.6. Despite the fact that recycling occurs, alternative 13 has no special water-supply benefits and is rated the same as most other alternatives, 3. The net effects of snowmaking are adverse due especially to the increased consumption of water; the alternative is rated 4.

Construction impacts. Alternatives involving an entirely new treatment plant would have local but not widespread effects and are rated 1 (alternatives 1,2, 13). Rehabilitation (alternative 12) would require a shut-down of the existing plant for prolonged periods, raising the problem of what to do with sewage in the meantime. Probably some type of trucking would be used, resulting in traffic impacts along the road to Taos. This option is rated 2. Even more impacts occur with alternative 4, because of the need to remodel every building in the District to install composting toilets. It deserves a rating of 5. Snowmaking would involve construction within the ski area, and, thus, would have impacts beyond those at the plant site. It is given a rating of 3.

Expansion Potential. The desirability of growth in TWSD is discussed in section 5.3. It is possible that within several years there will be proposals to expand any plant built today. Not all the semifinal alternatives would be equally easy to expand; for some options expansion would significantly increase problems of reliability and therefore increase the risk of river pollution. To reflect this issue each alternative was rated as to its expansion potential. In this context ease of expansion is considered a positive attribute because a flexible design would help protect the Rio Hondo if and when growth occurs; this rating does not consider whether growth itself is good or bad.

Total recycling (or more accurately, total treatment and discharge) produces such a clean effluent that it can meet stream standards even if flows approach 1 million gallons per day; it thus provides a virtually unlimited potential to absorb growth and is rated 1. At the other end of the spectrum is rehabilitation of the existing plant, which produces a relatively inefficient system which might be overwhelmed if expanded; thus alternative 12 is rated 5. The remaining alternatives are generally similar in expansion potential and can be distinguished on the basis of small differences in the efficiency of phosphorus treatment (more efficient treatment facilitates expansion).

Overall evaluation. Snowmaking as an add-on alternative is probably unacceptable (at least at a large scale) because of water-quality impacts. Aquaculture is by far the cheapest of the three innovative options; the others are probably too expensive to be considered cost-effective). (However, use of composting, dry toilets, or other low-flush toilets can be considered as a water-conservation technique for new development; see section 5.4.6). The major problem with aquaculture is that it is an unproven technology for solving problems of the type faced by TWSD.

Either of the conventional alternatives could prove to be the most cost-effective. Although a new conventional plant is more expensive than rehabilitating the existing plant, a new plant is considered by the facilities planning engineer to be a more reliable choice.

Based on the available information the choice lies among three alternatives: These can be listed in the following way:

Least Expensive (in order)	Most Reliable (in order)
1. Aquaculture	1. New Conventional Plant
2. Rehabilitation	2. Rehabilitation
3. New Conventional Plant	3. Aquaculture

This comparison shows that a major basis for selecting among the options would be the 'value' of spending money for reliability. Public input during the planning process has stressed the importance of reliability, operational flexibility, adaptability and related factors and the importance of minimizing the risks of plant failure and consequent pollution of the Rio Hondo. On the basis of this public input (which reflects the history of problems at the existing plant), a completely new facility (alternative 1) could be considered the most cost-effective choice.

However, the cost savings of rehabilitation (alternative 12) are substantial and this alternative *is* considered reliable (but less flexible or adaptable than alternative 1). The reliability is sufficient to meet NPDES standards; but sustained performance well below standards is less likely than for alternative 1. If straight economic considerations take precedence, alternative 12 would be the most cost-effective choice.

The innovative nature of aquaculture (alternative 2) would certainly increase the risks of failure to well beyond those expected from the two conventional plans; on the basis of public input these risks would be unacceptable and the alternative would be judged as not the most cost-effective. Successful operation of a pilot plant could alter this conclusion.

5.3 CAPACITY ALTERNATIVES

Substantial controversy exists over the appropriate size for wastewater facilities in Twining. The controversy arises primarily out of three basic issues: 1) the prospect that a larger treatment plant will facilitate growth of the ski valley resort complex; 2) disagreement as to whether or not such growth has a net beneficial or adverse impact on the human environment; and 3) concern that growth is inappropriate unless and until water pollution problems are solved. These issues are discussed as follows: section 5.3.1 summarizes alternative population projections for TWSD and identifies the treatment plant capacity needed to accommodate each projection; section 5.3.2 considers any limits to the development which can occur as a matter of law; section 5.3.3 discusses the policy elements of growth management; and section 5.3.4 evaluates the two major alternatives under consideration - a plant capacity which would minimize growth versus one which would allow new high-density development. Two related subjects of major public interest are the timing of any capacity increase (see section 5.4.8) and possible EPA funding of particular capacity alternatives (see part B of this chapter).

5.3.1 Relationship Between Plant Size and Development in Twining

Existing Development. Section 6.6.1 discusses existing development in the area. As is typical of a winter resort, the population of TWSD varies greatly over time, reaching a peak on holiday weekends when snow conditions are good. These peak populations determine the necessary size of wastewater treatment plants and many other facilities.

The existing peak population of TWSD is as follows.

	Skiers	Visitors	Employees/Residents	Total Population
Day Only	3000	300	200	3500
Night	1050	40	135	1225
Total	4050	340	335	4725

It should be noted that one of the large condominiums and most of the cabins are not hooked up to the existing sewage system, so that not all these people contribute to the flows at the existing treatment plant. Also, the limit of 4050 skiers reflects an interim limit on lift ticket sales and is less than the historic peak of 4400 reached in 1980.

Projected Development. Section 6.6.3 presents alternative projections of the future population in TWSD. There are four major types of growth which may increase the existing peak population. 1) Taos Ski Valley, Inc. wants to increase maximum sale of lift tickets from 4050 to 4800/day. 2) Existing lodge and condo owners would like to expand their operations by an average of 25 percent. 3) Many owners of vacant land have talked about possible new lodges or condos, encompassing a total of several hundred new units. 4) Cabins are likely to be built on a large number of lots which have been subdivided for that purpose.

The actual increase in peak population is difficult to predict because there is no land use or other formal plan for TWSD development. For reference purposes, several alternative population projections have been established. These forecasts include: the existing population; a 'maximum' population which assumes all announced plans become reality; and several intermediate levels, including one favored by TWSD.

	Existing	District Goal	'Maximum'
Skiers	4050	4800	4800
Non-skiing visitors	342	350	300
Employees	333	460	560
Total peak-day population	4725	5610	5660
Overnight Capacity	1225	2625	3550

The projections are explained in able 6-7 and associated text. The projections indicate that the maximum day population would increase by a small amount, in comparison to a much larger increase in the proportion of that population which stays in TWSD overnight. (The 'maximum' projection includes no development on the two largest parcels of vacant land within TWSD.)

The plans to set a lift ticket limit of 4800/day are discussed in the Taos Ski Valley, Inc., master plan (Flance, 1980); this document also presents plans to improve parking facilities, ski lifts and trails. A separate Environmental Impact Statement (USFS, 1981a and 1981b) considers these subjects and thus is limited to facilities which relate directly to skier use of the area. In contrast, this Draft EIS covers actions which relate to upgrading wastewater treatment facilities in TWSD and therefore addresses impacts related to development which may occur on private land.

Alternative Plant Sizes. Table 5-5 identifies seven alternative plant capacities. The alternatives reflect two different reasons for plant expansion: development of new ski and/or overnight facilities; hookups to existing high-density and/or projected low-density development. In the discussions which follow, two of these alternatives will be emphasized. Alternative B, a plant of 80,000 gpd, is the smallest facility which would effectively accommodate existing development; it provides no hookups for expansion of any resort facility. Alternative E, 95,000 gpd, is the largest capacity which could be implemented at this time. As Table 5-5 indicates, alternative E would allow somewhat less growth than the 'District Goal' (alternative F).

As discussed subsequently (5.3.2; 5.3.3) treatment plant expansion is not necessarily a critical factor controlling the probable environmental impacts from growth of the resort complex, especially if that growth is no more than the District goal.

5.3.2 Absolute Limits to Growth

There are three potential barriers which might set an absolute limit to development in Twining: economic, physical and legal.

TABLE 5-5. PLANT CAPACITY ALTERNATIVES

Based on Table 6-7. Total population equals ticket sales + non-skier visitors + employees. All gallon figures rounded off to nearest 5,000. See footnotes for explanation of assumptions. OSS = on-site systems a/.

	Alternative; Hookups	Ticket Sales	Total Population	Overnight Capacity	Capacity gal./day
A	Existing hookups only; no high-density growth; cabins use OSS	4050	4725	1225	70,000
B	Extend hookups to Kandahar and 5 cabins; no high-density growth; most cabins use OSS	4050	4725	1225	80,000
C	Existing hookups plus skier limit raised; no major new overnight facilities; most cabins use OSS	4800	5550	1695	80,000
D	Extend hookups to Kandahar, 5 cabins; skier limit raised; no major new overnight facilities; most cabins use OSS	4800	5550	1695	85,000
E	Similar to D but some expansion of overnight facilities	4800	5580	2185	95,000
F	Similar to E but even more overnight facilities; 'District Goal'	4800	5610	2625	105,000
G	'Maximum' development; all cabins hooked up; actual growth could exceed this amount if all vacant land is developed	4800	5660	3550	150,000

Many assumptions must be made in order to convert a population number into a treatment plant capacity; see Table 6-7 for major assumptions made in this EIS. The most important factors are: for existing facilities day visitors are assumed to contribute a sewage flow of 10 gallons per day while overnight visitors/residents contribute 50 gallons per day; for new facilities these values are assumed to be 33 percent less due to the use of water conservation measures such as no-flow toilets; it is assumed that the existing infiltration problem will be solved prior to completion of any new treatment facilities; hookup policies vary as indicated in the table; and it is assumed that peak weekend flows would be stored in equalization basins and the plant designed to accommodate the average flows for the busiest week of the winter season.

a. 715 persons in cabins (including 460 new pillows) would be served by OSS for alternatives A-F; these people would be served by the central treatment plant for alternative G.

Economic Constraints. Land prices in Twining are among the highest in New Mexico, demonstrating that there are strong economic forces for the expansion of the resort (see 6.6.1). In recent years actual construction of high-density lodges and condominiums has stopped because of TWSD's moratorium on sewer hookups and the desire of developers to postpone construction until reasonably priced hookups become available. However, in 1980 some developers announced their intention to construct condominiums without waiting for new hookups; these builders propose to independently install and operate small wastewater treatment plants of extremely advanced design, capable of producing nearly pure water. These facilities would be similar to those discussed for treatment alternative 13 (see section 5.2).

The cost of building independent facilities is high, perhaps $10,000 per condominium unit (Wilson, 1981). However, this represents about five percent of the selling price of the units and in itself is not considered to be a constraint on development. Clearly there may be a saturation point beyond which the economic benefits of further development (i.e. the price at which units can be sold) will not warrant expenses of this magnitude. This saturation point cannot now be identified; persons familiar with the area believe that growth to at least the amount indicated by the District's desired population is economically feasible (Wilson, 1981).

Physical Limits. Factors such as soils and terrain will influence the location and character of development in Twining. However, there is ample vacant, buildable land within the District to accommodate even the largest of the population projections (see section 6.6.2). Many area residents believe that growth of the resort complex is limited by physical changes downstream of Twining. These changes reflect considerations of growth policies (see section 5.3.3) rather than any specific physical threshold or regulatory mandate.

Legal Barriers. County land use regulations and zoning laws would provide a firm legal basis for managing development and (if appropriate) limiting growth in Twining. While some county planning has been done, there is no time frame for adoption of land use regulations. The rules which do exist - such as for subdivisions - either do not address commercial development or can be complied with readily if project engineering is adequate. Similarly, state water-rights laws can be met if economic incentives are sufficient. That is, purchase of water rights on the open market and transfer of the rights from downstream irrigation to upstream domestic use is practicable where the value of the newly developed land is high. Public opposition to such transfer is common in Taos County, but based on precedent the transfers are normally approved unless there are unusual hydrological or legal conditions.

The wastewater management authority of TWSD is substantial and the District could at least partially limit development by using its powers to allow (or disapprove) hookups and independent treatment plants. These powers can be exercised for 'health and sanitary purposes', but have never been subject to judicial review in New Mexico (Rubin, 1981). Given economic incentives for development in Twining, it is possible that persons affected by any TWSD policy against new hookups and independent plants would institute litigation to determine if the District's policy was within their powers. One possible policy which might fit the requirements of 'health and sanitary purposes' is discussed in section 5.4.9, sub-section on hookup policy.

At this time District policy is to exercise its authority only as necessary to meet state or federal water-quality regulations. The current moratorium on hookups was imposed for that reason. The policy of the District toward new development is as follows (Stagg, 1981):

- TWSD will not interfere with private property rights to develop land except as necessary to comply with water-quality regulations;

- TWSD will encourage new development to hookup to the central treatment plant so long as capacity is available and standards will not be exceeded;

- TWSD will consider short-term limitations on hookups during periods in which plant performance and standards compliance are being verified;

- As these interim limitations are periodically raised, TWSD will allocate new hookups on a priority basis (see Section 5.4.9 for priorities);

- TWSD will attempt to provide at least the capacity associated with the 'District Goal' population (105,000 gpd), but will discourage growth beyond that point;

- TWSD will not resist independent treatment plants, provided that all regulations can be met and there is no hookup capacity available at the central plant.

A key factor in the amount of growth is the relationship between development and water-quality standards. Stream standards are the basis of establishing the maximum amount of pollution (effluent limitations) which may be discharged to the Rio Hondo (Table 4-1). As growth increases, the amount of raw sewage increases; there is a limit to the extent to which treatment can clean up the raw sewage. Eventually growth must stop or there will be too much contamination of the river and the standards will be violated.

The history of problems at the existing facilities may suggest that the contaminant limit has been reached already. However, the analysis of the facilities planning engineer is that these problems result from inadequate system design, construction and operation and not from inherent limitations in treatment technology (Leyendecker, 1981). When the Twining situation is analyzed using 'standard' concepts of sanitary engineering, the conclusion reached is that Twining can grow somewhat without exceeding the water-quality limits imposed by the state regulations; the actual amount of allowable growth depends on many assumptions about how such growth would affect the river.

The concept of a water-quality limit to development is critical to understanding growth-related issues in Twining and is presented in detail below.

The discussion is not intended to argue for or against a given amount of growth or a given amount of contaminant discharge, but only explains how the regulations are likely to work. As will be shown, the regulations imply a limit to development in Twining over the short-term, but it is a 'soft' threshold rather than an absolute barrier to growth.

The calculation of a maximum allowable pollutant discharge is known as a wasteload allocation. Section 6.2.2 and Appendix B.4 explains how EID has calculated TWSD's wasteload allocation for phosphorus, which is the critical pollutant potentially limiting plant capacity. The principals of the wasteload allocation are as follows.

1. EID allocates phosphorus wasteload on a first come, first served basis. In the case of the upper Rio Hondo, 100 percent of the phosphorus wasteload is allocated to TWSD, assuming that TWSD chooses to use the entire allocations. (Note: this does not result in total allocation of the downstream phosphorus wasteload; see Appendix C.7.)

2. The maximum discharge of pollutants allowed from TWSD is established so that stream standards will not be exceeded during very low-flow periods when the river has minimal dilution capacity. (The specific period is the driest week in ten years.)

3. Very conservative assumptions are made about: a) the impacts of non-point source pollution; and b) the treatment efficiency of an advanced wastewater treatment plant. The wasteload allocation is based on a 'worst-case' analysis specifically intended to protect the Rio Hondo even if the growth of Twining greatly increases the total amount of pollution which needs to be controlled.

4. The discharge from a central treatment plant must not be so large as to exceed the wasteload allocation. If a plant such as described by alternatives 1, 2 or 12 were built, a discharge of more than 95,000 gallons per day would contain more pollutants than allowed by the allocation, and could cause violation of the stream standards during low-flow periods. Thus, at this time a 95,000 gpd plant is the largest feasible facility. For an alternative such as number 13, which provides much more clean-up of wastewater, the allowable discharge could be five or ten times greater.

5. The limit on total pollutant discharge to the river is relatively fixed so long as the stream standards remain unchanged. However, TWSD can expand the total gallons discharged by either cleaning up the effluent from the central treatment plant, or cleaning up pollution from non-point sources, or both. Because the initial calculations are based on a worst-case analysis, the prospects for such clean-ups are good. (For example, EID assumed increased pollution of the river by on-site systems; the simple extension of sewers to the Kandahar condominiums would help clean up the river and possibly allow a central plant to increase its discharge to well beyond 95,000 gpd.) Thus 95,000 gpd is not necessarily a permanent limit to the size of a treatment plant in Twining. It is only a

(non-binding) estimate of the maximum size of plant which, based on permit conditions and a worst-case analysis, would not cause violation of the stream standards.

Another way of viewing the wasteload allocation is to observe that the stream standards for the upper Rio Hondo will be met so long as the discharge of phosphorus into the river does not exceed about 2 pounds of phosphorus per day. Presently, non-point sources contribute 0.5 pounds per day and the TWSD treatment plant discharges 3 or 4 pounds per day; thus, the standards are exceeded. EID has assumed the non-point source component will increase to about 1.1 pounds per day because of extensive development using septic tanks. This leaves 0.9 pounds per day which will be allowed from the TWSD treatment plant. The existing facility cannot meet that requirement, but once advanced treatment facilities are built (e.g. alternative 1 or 12), even routine operation would be expected to produce an effluent with no more than 1 mg/l of phosphorus. If the total wastewater flow does not exceed 95,000 gpd then the facility would comply with the 0.9 pounds per day limit. There is no physical reason why TWSD cannot comply with the regulations.

A plant larger than 95,000 gpd could comply with the regulations if any of the following occur:

- control of non-point sources to less than 1.1 pounds per day (each 0.1 pound decrease would permit approximately a 12,000 gpd increase in capacity);

- better than routine operation of the new facilities so that effluent concentration is consistently less than 1 mg/l phosphorus (each 0.1 mg/l clean-up would permit approximately a 12,000 gpd increase in capacity);

- the combined effect of the above factors could allow a 150,000 gpd plant (alternative G in Table 5-5) if non-point sources were held to 0.5 pounds per day (the present level) and the effluent quality consistently was better than 0.8 mg/l;

- construction of a 'super' plant (alternative 13; effluent should contain 0.4 mg/l phosphorus or less, and a capacity of 375,000 gpd would not violate regulations, assuming that other parameters were controlled, such as by reduction of ammonia-nitrogen).

On the basis of the wasteload allocation, there will be a legally enforceable limit on the phosphorus discharged from any new treatment plant built by TWSD; to ensure compliance with the regulations, the maximum plant capacity would be 95,000 gallons per day if alternative 1, 2 or 12 were selected. Although the effluent restriction is not a direct limit on growth, it has the practical effect of forcing TWSD to proceed with special caution before expanding the plant beyond 95,000 gpd. Because EID has allocated the entire wasteload to TWSD, independent discharges to the Rio Hondo in the Twining area would not be allowed unless the effluent were of such high quality that it produced no addition of phosphorus to the stream, which would be a difficult requirement to meet. This does not preclude independent discharges of effluent to ground water (as from septic tanks) which are covered by separate sets of regulations.

As shown in Table 5-5, a plant of 95,000 gpd would allow an increase in the TWSD population of 750 skiers and about 560 overnight residents. This is in addition to growth (460 overnight residents) which could occur through the low-density spread of cabins which use septic tanks (since, as noted above, EID's worst case allows for greatly increased pollution from such non-point sources).

Summary. Water-quality regulations are the only existing legal limit to growth in Twining. The regulations set a limit on phosphorus discharge which, in the short-term, would limit plant capacity to 95,000 gpd (compared to present base-area flows of 80,000 gpd). Over the long-term the regulations require only that any larger capacity not cause violation of water-quality standards; these standards do not impose any specific limit on gallons discharged and thus provide no firm obstacle to considerable expansion of sewage facilities and considerable growth of the resort complex.

5.3.3 Growth Policies

Even though growth in Twining apparently is not constrained by economic, physical or (over the long-term) existing regulatory factors, there are many who believe that some limit should be placed on new development in order to protect the local and regional environment. Many citizens consider that the optimum population has already been reached or exceeded; others believe that the resort could double in size and still be 'small enough'. The debate over the proper amount of growth has concentrated on several issues: water resources; the overall environment of the Hondo valley; the economy of the Taos region; and social and cultural changes.

One way to focus the debate is to compare the impacts of alternative B (80,000 gpd) and E (95,000 gpd). Table 5-6 summarizes the major differences between these two capacities; the analysis is based on more detailed statements made in chapter 6, as referenced in the table. There are three major implications of the information presented in Table 5-6. First, there is the potential for considerable impact (both beneficial and adverse) from the expansion of the ski valley resort complex, even without any increase in sewage treatment capacity. Second, substantial economic benefits would be associated with a larger treatment plant; these must be balanced against changes in environmental quality in the Rio Hondo watershed. Third, as in the past, positive and negative impacts will not be equally shared. On balance the impacts suggest that disagreement will remain as to whether the development is desireable or objectionable.

Underlying much of the discussion which follows is the distinction between peak and total use of the resort complex. Peak use reflects the maximum population of skiers, lodgers and other visitors/residents who may occupy the

TABLE 5-6. IMPACTS OF CAPACITY ALTERNATIVES B AND E

Impacts from Alternative B relate to: no increase in skier limit (remains at 4050); increased visitation during off-peak periods (winter); small increase in summer; 470 new pillows in 94 new cabins (added to 295 existing pillows); no increase in commercial facilities (remain at 931 pillows); see Tables 6-7, 6-8, 6-9. In reality, impacts associated with alternative E would probably also occur from alternative B, but serviced by on-site systems rather than a central treatment plant.

Impacts from alternative E would include all changes listed for alternative B, plus increase in skier limit from 4050 to 4800, proportional (20 percent) increase in off-peak use; expansion/construction of lodges and condos to provide for 50 percent more overnight capacity in commercial facilities of base area (489 new pillows added to 931 existing) a/. As stated above, all these changes could occur under alternative B; however, alternative E would facilitate these changes. Impacts marked with asterisk (*) could occur outside Twining if skier limit is increased, but overnight capacity is not (symbolically this should be achieved by alternative D).

Factor	Alternative B (80,000 gpd)	Alternative E (95,000 gpd)
Populations; see Tables 6-7, 6-8, 6-9	Peak day remains at 4705 Overnight capacity increase from 1226 to 1696 Annual visitation increase from 275,000 to 520,000	Peak day increase to 5579 Overnight capacity increase from 1696 to 2185* Annual visitation increase from 520,000 to 615,000 If half new jobs in Twining taken by existing residents, then 38 persons would immigrate to region because of increased employment
Water Resources; see Section 6.2.7	Reduce pollution due to improved wastewater treatment; increase in potential non-point source pollution from cabins (but may be controlled - see 5.4.2); potential decrease in other non-point sources (see 5.4.7)	Reduce pollution due to improved wastewater treatment (but, if plant should fail, pollution would be greater than from B); potential increase in non-point source pollution from cabins (but may be controlled - see 5.4.2); more potential for construction impacts* (see Table 6-1); potential decrease in other non-point sources (see 5.4.7)
	Need for 11 acre-feet/year of water rights (including expanded snowmaking); can be obtained from rights already held by TSV, Inc. and/or TWSD	Need for 4 additional acre-feet of water rights beyond impacts of alternative B; of these 1 AFY would be for the skier limit increase and 3 AFY* would be for the increase in overnight capacity; can be obtained from rights already held by TSV, Inc. and/or TWSD
	Increase in annual visitation would require an additional 5 acre-feet of rights outside of TWSD (e.g. Amizette, Valdez, Arroyo Seco or wherever the skiers are lodged)	Could reduce the demand for regional water rights from 5 to 2 AFY because skiers stay in Twining, not elsewhere*
	The historic decline in streamflow in the Rio Hondo would not be significantly affected by either alternative because it is caused by reforestation of the watershed and reduced snowfall, and not by development at the ski valley	
Traffic, Air Quality, Noise (See Section 6.5, Table 6-8, 6-9)	Peak traffic stays at 1650 cars/day Total traffic increase from 104,000 vehicle-trips per year to 196,000 vehicle trips per year b/	Peak traffic increases by 310 cars to 1960/day Total traffic increase from 196,000 to 255,000 vehicle trips per year b/
	Air emissions, noise and energy use increase proportionally but standards not violated	Air emissions, noise and energy use increase proportionally but standards not violated
Economics c/ (See Table 6-8, 6-9)	Increase in revenues from $27.5 million to $52 million/year; jobs remain at 1560	Increase in revenues from $52 to $61.5 million per year; 190 additional jobs (total 1750)
Culture; Sensitive Resources (See Section 6.5, 6.6.6)	Growth/impacts part of complex factors which influence changes in traditional agrarian society; significance of impacts widely debated	Similar to B but: more tourist influx and cash flow; greater portion of tourists lodge in TWSD*
	Possible increase in use of wilderness area and trespass on Indian lands (but small compared to problems if area becomes summer resort)	Similar to B, but slightly greater because of more skiers and overnight residents*
Other (See Table 6-1; Section 6.7, 6.6.7)	Construction on 94 cabin lots; improvements in ski area as described in USFS (1981) and Table 6-6; construction at treatment plant; investment of energy, chemical and money to improve wastewater treatment; much higher sewer rates than at present	Similar to B except: addtional construction on 3 - 5 acres of base area*; increase in rates more widely shared

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a. If the District were to so allow, some or all of this change could occur in high-density development using independent treatment systems.

b. Assumes no benefits from shuttle service or from reduced commuting which may result from expanded lodging in Twining.

c. Values are for a good ski year and, as discussed in Table 6-9, more than half occur in Taos region, not in Twining.

area during the busiest periods. Peak use has a strong influence on such things as the capacity of facilities (from sewage plants to ski lifts to parking lots), and does influence some key environmental factors (most notably the number of jobs associated with the resort and the peak level of traffic, which affects air quality, road congestion and safety).

In contrast, annual use reflects the total yearlong activity at the resort complex, which will be some percentage of the peak. Currently the annual use in winter is less than half the peak, while summer use is very small; but these proportions could change, and indeed, average winter use (as a percentage of the peak) can be expected to increase simply because of the plans to limit that peak. Most of the environmental impacts of growth in Twining reflect changes in the annual use. These effects include the total water pollutants discharged; water rights needed; total traffic (thus energy use and total discharge of air pollutants); and revenues. Increased annual use requires absolutely no additional wastewater treatment capacity, which is one reason why the concept of 'no-growth' cannot be applied to any of the capacity alternatives.

Expansion Without Additional Treatment Capacity (Alternative B). Table 5-6 indicates very substantial economic and environmental changes resulting from an 80,000 gpd sewage treatment plant. Thus, alternative B is properly considered as a 'no-hookup' capacity (providing for no increase in high-density development) rather than as a no-growth option. Three types of changes can occur without expanded central treatment capacity. The most significant change relates to increased visitation in off-peak periods, which increases total use of the area. It is difficult to predict the extent to which off-peak use of the area will grow; Table 5-6 assumes an approximate doubling of total annual visitation, even if peak capacity is unchanged. Impacts on water rights, traffic and revenues would double also.

The second change which does not require central treatment capacity is the construction of cabins on 94 vacant lots designated for that purpose in the Pattison subdivision. These cabins, which could use on-site systems as do most existing cabins, would add an estimated 470 pillows to the overnight capacity of Twining, an increase of nearly 40 percent compared to present conditions.

Both the above changes would occur with or without expanded treatment capacity; that is, the impacts are associated with either alternative B or alternative E. The third change would be expected only if alternative B is chosen and TWSD has no new hookups to offer. Given existing development pressures, it is likely that there would be some construction of small-scale high-density units or commercial facilities in the base area, using advanced on-site systems or independent treatment plants which discharge a very high quality effluent to ground water. For example, this could include triplex or fourplex condos; commercial facilities (including increased skier capacity using up-mountain restrooms); and expansion of existing lodges and condos. It is difficult to predict the extent of such development. Ultimately the effects could approach, equal, or even surpass those associated with a 95,000 gpd plant. For purposes of this analysis, the effects are assumed equal to those of a 95,000 gpd plant, and thus are the same as those listed under alternative E. This approach has two implications: it suggests that virtually all of the effects of a 95,000 gpd plant may occur from an 80,000 gpd facility; and it allows the table to highlight (as the effects of alternative B) those parts of the TWSD expansion which absolutely do not have even a hypothetical relationship to the choice between the capacity alternatives.

Note that Table 5-6 assumes no major expansion of the resort in summer. Were Twining to become a major yearround recreation area, many of the impacts listed for alternative B might again double, without requiring any increase in sewage treatment capacity.

Additional Impacts of Alternative E. Expansion of the treatment plant to 95,000 gpd would allow large-scale expansion/construction of lodges and condos in the TWSD base area, and fully accommodate the intended increase in skier capacity. Such development would produce incremental growth beyond that described in the previous sub-section (although, as noted, much of the incremental growth might occur using on-site systems). The growth would increase peak use of the area by some 20 percent during the day and 50 percent during the night; annual use would increase in similar proportions.

In general, the impacts listed in Table 5-6 directly parallel the amount of growth. Thus, factors which relate to skier visitation (both peak and annual) would increase on the order of 20 percent, while factors which relate to high-density overnight capacity (both peak and annual) would increase on the order of 50 percent. Note that most of the direct economic benefits of the industry (revenues and jobs) relate to skier visits; once off-peak use approaches the limit of 4800 there would be minimal additional growth in economic benefits from the resort. Also, if the skier limit is increased without expansion of overnight capacity, there would be a corresponding expansion in the lodging industry somewhere in the Taos area; if the growth does not occur in Twining it could still occur in the Hondo Valley (Amizette, Valdez) or along the road to Taos (Arroyo Seco, El Prado).

The Sharing of Beneficial and Adverse Impacts. A first glance at Table 5-6 might suggest that the economic benefits associated with ski industry growth are so large as to fully justify such growth, especially when the adverse impacts are not projected to violate any regulations. However, an important aspect of the benefits is that they are concentrated in the commercial sector of the economy. Although the revenues certainly benefit the entire region, a good portion can be identified as flowing through the hands of some of the more affluent members of the community (comparatively speaking), including property owners in Twining. In contrast, not all area residents share in these revenues directly and many do not want the service jobs which could provide such a direct share.

Adverse impacts are also not equally shared. Those who most benefit do incur some adverse effects; this is especially true of existing residents of

Twining, many of whom do not welcome the prospect of resort growth. However, many of the adverse effects are concentrated in the lower portions of the Hondo valley and/or along the Twining-Taos road where there is no special concentration of the economic gain. Although in many cases the size of the adverse impacts may seem relatively small (as compared to environmental standards or the total resources available), the effects are generally very visible and involve changes to elements of the environment which some area residents consider to be highly sensitive because of their importance to the maintainance of culture and tradition.

It appears that the distribution of effects, as well as the total effects, may account for much of the controversy over growth in Twining. Many local citizens see the economic benefits of skiing as very positive, while the adverse effects of tourism are small, acceptable and not necessarily in conflict with traditional values. These people include (but are not limited to) many (but not all) members of the business sector of the community.

In contrast, others consider the tourist economy to provide 'money without value' and to be detrimental to the native culture. They find no reason to support expansion of the ski area. Many persons who hold this position live in areas where the cultural traditions are the strongest, the adverse impacts of tourism are visible, and the economic benefits of the industry are least evident. This includes (but is not limited to) many (but not all) residents of Valdez, Arroyo Hondo, Arroyo Seco and Taos Pueblo.

Like any analysis which deals with human attitudes, this discussion is too simple. For example, some persons support a larger treatment plant not because of economic issues, but because development is viewed as the right of property owners and inevitable given pressures in Twining; it is considered common sense to plan accordingly and build a facility which will accommodate the change that is bound to occur. Conversely, not all of those with an economic interest in tourism are enthusiastic about growth in Twining; there are residents of the District who do not relish the possible lifestyle changes which could result from resort expansion. While a cost-effectiveness analysis does consider who may gain or lose from certain actions, the absolute balancing of benefits is not required.

Summary. The clearest implication of Table 5-6 is that the effects of growth in Twining are large, regional and deserving of community attention. However, the analysis does not definitively answer the question of what should occur. Indeed, because the conflict is often stated in terms of economics versus culture, and because there are strong interest groups representing different perspectives on the conflict, it is by no means certain that the question *can* be fully and finally resolved. It is clear that effective solution of the issues will require decisions at the community level, through participation in a democratic planning process. Moreover, given the intensity of the debate, very substantial research and analysis would be needed for a comprehensive growth policy for even an area as small as Twining. Refer to Moser and Peterson (1981) for a summary of how one Austrian ski village (located in a somewhat more sensitive alpine setting than Twining) dealt with the "Limits to growth" question through studies performed by 80 scientists over a period of 10 years.

Even with an adopted plan, the probable policy would be one of controlled growth. For example, it would be difficult to limit the increased use of the resort in off-peak periods; rather, this may be a 'given' which influences policies toward other types of growth. Control of peak skier activity would be possible (and in fact is to be implemented by TSV, Inc.). Controls as to commercial facilities in and near the resort would likely govern the location and type of development, so long as the demand for facilities is strong.

Public participation in preparation of this EIS provides a major forum for discussion of these three types of development, but not for the larger questions of economic development and cultural evolution of Taos County. Even though the direct impact of treatment plant capacity on development may be minimal, plant size is certainly symbolic of that part of the growth debate which concerns tourism (see 5.3.4 for further discussion of this point). Thus, some members of the public may consider decisions made by EPA as a vote in support of or against different growth policies. However, the EIS is too narrow a document to resolve all (or even most) of the issues which concern local citizens. Further, it is doubtful that the citizens would desire or profit by growth directives imposed by a federal agency. Thus, while growth issues certainly bear on EPA's evaluation as to the best approach to wastewater management in Twining, it is not the intent of the EIS to provide definitive guidance as to how Taos County should manage its future.

5.3.4. Evaluation of Alternatives

Table 5-6 indicates the dimensions of change which are associated with two of the seven capacity alternatives. Based on discussions in the previous section, it is difficult to decide which capacity is most cost-effective. At this time, EPA has not made such a decision. This section reviews the major factors which will be considered; additional information is provided in chapter 6. In particular, sections 6.2.7 (water resources) and 6.6.6 (social and economic impacts) contain much of the supporting data for the analysis which follows. Although substantive matters are important in the discussion, much of the public controversy has a philosophical basis. Thus, the plant-capacity decision can be viewed (in part) as a symbol of the community debate over the changing environment.

Comparison of the Seven Alternatives. Although Table 5-6 deals with only two of the seven alternatives listed in Table 5-5, it provides the basis for comparing all seven, as follows.

- Impacts from alternative A (70,000 gpd) would be identical to those from alternative B (80,000 gpd), except that the former would have less water-quality benefits because it would not improve the management of wastewater from the Kandahar condominiums.

- Alternatives C and D (80,000 and 85,000 gpd) would have the same impacts as alternative E, except that the effects of increased overnight capacity would occur outside of TWSD rather than inside; also, alternative C would have the same lack of water-quality benefits as alternative A.

- Alternative F would have impacts in proportion to those listed for alternative E; all the incremental effects of increased overnight capacity listed in Table 5-6 would approximately double if this larger facility (105,000 gpd) were built. (For example, water rights would increase by another 3 acre-feet per year.)

- Alternative G (150,000 gpd) would increase all the overnight impacts enormously; very roughly the effects would be five times as large as the overnight-capacity impacts of alternative E.

On the basis of these comparisons, four of the alternatives are unlikely to be very cost-effective. Alternatives A and C fail to meet widely accepted goals of providing optimum wastewater management in the area. Alternatives F and G exceed the size defined by the wasteload allocations.

Alternatives B and E are characterized in Table 5-6, and are discussed in the next section. Alternative D can be considered identical to E, except that the impacts of overnight capacity listed in the table would occur outside Twining rather than within the District.

Alternative B or Alternative E? Public discussion of the 80,000 and 95,000 gpd plants has revealed some agreement that, regardless of what label is assigned to the facility, TWSD should meet stream standards for existing wastewater flows before any expansion is contemplated. Section 5.4.9 outlines methods of such a phased expansion. If this approach is assumed valid, then the two major capacity alternatives are:

build a facility which allows some growth (95,000 gpd); however, actually treat only existing flows until the facility fully complies with the effluent limitations, and then gradually allow new hookups (development); or

provide the capacity only for existing flows (80,000 gpd), and once the plant is in compliance, gradually expand the plant and the discharge.

A variation on alternative B, to build an 80,000 gpd facility and never expand it, has not been accepted by the District. Even if the District chose to limit the plant to this size permanently, the legal constraints discussed earlier would not necessarily preclude construction of additional treatment plants by other entities. The issue of independent plants is discussed in 5.4.9 (sub-section on hookup policy).

It is difficult to choose among these options on the basis of environmental impacts alone because: a) substantial environmental change is predicted with or without an expanded treatment facility; and b) the changes are not uniformly good or bad, but include both substantial economic benefits and small but real adverse environmental effects which will be highly visible and judged by many as representing a substantial threat to traditional culture.

The problem of selecting the 'best' plant size is compounded because, from an engineering point of view, a sewage treatment plant of 80,000 gpd capacity is virtually identical to one of 95,000 gpd capacity. That is, the hardware is about the same in type and size, and operations don't change much. What does change, of course, is the number of hookups allowed and the extent to which growth is accommodated through a central treatment plant versus independent systems.

The debate about capacity has many symbolic aspects, which of necessity must be simplified here. At the most basic level, support for a larger treatment plant is generally considered as support for (or acceptance of) growth in Twining, while support for a smaller treatment plant coincides with an endorsement of a no-growth (or low-growth) policy. More specifically, the two alternatives symbolize the following attitudes (individuals favoring one or the other options may endorse only some of these attitudes, and indeed may support some conflicting principles).

Alternative B (80,000 gpd). In general, proponents of a small plant (or opponents of a large plant) favor a no-growth policy for Twining; often this policy extends to other types of tourism and to all types of non-traditional development. It is observed that protection of the Rio Hondo is most easily accomplished by never causing any problems with the river in the first place. For these individuals the benefits of growth (economic) are not worth the price (environmental and cultural). Some identify tourism and skiing as major threats to their water resources and agrarian lifestyle, and thus incompatible with fundamental traditions, ethnic identity and economic survival. Others acknowledge some benefits from the ski industry, but believe there has been enough development of this type.

Some of those who favor no-growth believe development can be stopped by some means; others recognize that some development will occur but do not want to encourage or support it in any way. The endorsement of a small plant (even if it may soon be enlarged) represents this resistance to changes which may adversely impact water resources and local culture. Ideally the position is viewed as actually slowing growth, but even if it does not do so directly, it serves as a message to all concerned that there is a community concern about development. The specific message to EPA is that funding should be limited to the smaller facility. Grant funds should not encourage undesireable development; if growth does occur, all costs should be borne by those who benefit. The message to TWSD is that the commitment to a larger facility should occur only after the initial facility is in full compliance with the regulations. Because of past problems, and as a matter of equity, a larger plant cannot be justified unless and until TWSD demonstrates both good faith and actual competence in management of a smaller facility.

Alternative E (95,000 gpd). In general, proponents of a larger plant believe that the revenues and jobs associated with skiing have been a major factor stabilizing and improving economic conditions in the Taos area; this development has represented real progress and made it possible for at least some Taosenos to sustain their rural traditions. They recognize the urgent need to correct existing pollution problems in the Rio Hondo and believe that once this is done the adverse effects of additional growth would be small and acceptable if managed properly. Often, growth is viewed as the inevitable result of the free enterprise system and private property rights. It is considered common sense to plan for such development; construction of a plant which is smaller than ultimately needed is viewed as an invitation to repetition of past wastewater treatment and water-quality problems. Thus, they reason that the stresses on the watershed are unavoidable and the key is to use appropriate technology to control these stresses and minimize harm.

The specific message to EPA is to fund a facility which will solve the real wastewater management needs of Twining, especially since a decision to the contrary will not actually stop (or even slow) development. Persons concerned with facility financing point out that the hookups allowed by a larger capacity will allow TWSD to assess treatment costs to new development, provide for a wider sharing of the expenses of a new plant, and reduce the burden on existing residents. It is also noted that TWSD can respond fully to concerns about water-quality by building a larger facility but phasing in hookups in response to demonstrated successful plant performance.

In summary, there are two quite different points of view, each with supporting evidence. Despite some overlap in attitudes, the issues are often construed as 'progress' versus 'tradition'; economics versus culture; using technology to mitigate environmental stress versus minimizing the stress itself. Similar issues are often debated at the regional, national and even global scale; they are not easily resolved but this in no way diminishes the intensity of the debate.

The DEIS and EPA's public hearing will solicit further input on this subject. A decision as to the most cost-effective capacity will ultimately be made; however, it is by no means certain that the choice will be unequivocal, and it may be based as much upon considerations of changing federal policies and funding levels as on a determination that one or the other of the above arguments is 'better'. Certainly, in itself, the decision will not resolve fundamental conflicts of progress vs. tradition, et al. (See also part B, p. 5-47.)

5.4 OTHER ALTERNATIVES

The development of a complete wastewater management system requires consideration of many factors beyond basic treatment concepts and plant capacity. This section discusses methods for addressing the remaining components of an effective facilities plan (keeping in mind that the plan, like the EIS, is a draft document subject to revision). For many components the planning effort developed a single 'most effective' approach, because of the general need to provide the best practicable treatment works in Twining.

5.4.1 Collection System

The existing collection system experiences a severe infiltration problem (see Appendix A.2 and BLL, 1981). Approximately 20,000 to 25,000 gpd of natural ground water must be treated at the plant in winter during a wet year, accounting for 20 to 65 percent of all inflow. In addition to increasing wastewater volume and treatment costs, the infiltration interferes with the efficiency of treatment because it dilutes the raw sewage and lowers its temperature substantially.

According to the draft facilities plan, the lowest-cost solution to the problem is to rehabilitate the collection system. The District has received a step 1 grant increase to study the problem in detail and to undertake a solution. The initial action will be to survey the existing system using television equipment. Then "slip-lining" will occur where possible (new pipe will be inserted inside the old) and replacement sewers will be required where deterioration was found to be excessive. The rehabilitation is estimated to cost approximately $150,000 and should reduce the rate of infiltration to no more than 1,600 gpd. Rehabilitation would have local construction impacts (see Table 6-1) but would eliminate interference with the treatment processes and thereby increase the reliability of the facility.

Because of high costs ($2,000 or more per connection plus the expense of treatment plant expansion), no collection line extensions are proposed in the draft facilities plan. Service lines would be extended from existing collection lines to the Kandahar (a short distance) and to a few existing cabins close to the river. Remaining cabins would continue to use on-site systems.

5.4.2 On-site Systems

Although on-site systems (OSS) are not considered an effective overall solution to TWSD wastewater management (see alternative 3, Section 5.2), they can be used in some circumstances. Two distinct alternatives can be considered. One approach would be to defer to EID regulations and have that agency continue to have full jurisdiction over new systems. This choice would simplify TWSD management and help contain costs; however, it might not fully address problems of phosphorus (and other) pollution from OSS because EID regulations are sanitation oriented, not water-quality oriented. The wasteload allocations take this impact into account and violations of stream standards would not be expected; nonetheless, optimum protection of the river would not be accomplished. Also, this alternative would accomplish little of the flow reduction which could be obtained from a more active approach.

The other alternative is for TWSD to choose to become involved in at least some and perhaps all aspects of OSS management. One of the major steps would be the requirement that new development use dry or extremely low flush toilets (see Section 5.4.6). This would both reduce total wastewater flows (to the treatment plant and to OSS) and reduce total pollutant loadings. A second major step would be to become actively involved in the management of OSS. One aspect of this effort would be to provide guidance on the best types of systems; this would touch both upon the need for good sanitation (the conventional concern and main focus of EID regulations) and the need for water-quality protection (TWSD's specific mandate). Appendix B.5 summarizes the alternative technologies which might be considered; these alternatives are of value because soil and slope conditions present severe limitations to the use of more conventional technologies (such as septic tanks and drainfields). In addition to identification of appropriate technology, TWSD's management efforts could include: special remedial efforts to correct surfacing of wastewater; periodic inspection of advanced systems; and specialized maintenance of advanced systems. The cost of providing such services is estimated at about $7500 per year for a part-time sanitarian (who could be a part-time treatment plant operator). To the extent that these alternatives would reduce wastewater flows and improve river quality, the investment would ultimately allow the District to provide a greater number of new hookups.

5.4.3 Specific Plant Site

A large number of plant site alternatives were considered in section 5.2. Alternatives involving a major change in location have many disadvantages (see section 5.2). The existing site is considered suitable for any of the 'semi-final' alternatives (Table 5-4); no reasons have been identified for incurring the expense of relocation. Thus, no additional siting alternatives have been evaluated.

5.4.4 Sludge Management; Disinfection

The draft facilities plan determined that sludge stabilization can be accomplished effectively by sand-bed drying, without special processing. Sludge would be stored in an aerated basin during winter months (maximum 180 days) and dried on five sand beds in the warmer months. Two additional sand beds (greenhouse-covered) would be available for winter drying as needed. Dried sludge would be disposed of by hauling to the Taos municipal landfill; because of the small volume of material, no adverse effects would be expected. Alternative methods of disposal, such as reuse, were not considered in the draft facilities plan because of minimal benefit and possible environmental contamination from pathogens (see also section 5.4.5).

Of the many possible disinfection alternatives, use of iodine and ultraviolet radiation were considered excessively expensive. Chlorination, the most conventional choice, has several adverse impacts: it may produce carcinogenic trihalomethanes; if effluent is overchlorinated, the resulting chlorine residuals can be toxic to aquatic life in the Rio Hondo; delivery of chlorine requires transport of a hazardous material through downstream communities; and chlorine is relatively ineffective in killing viruses and parasites, pathogens of concern to downstream residents.

Ozonation (using ozone produced on-site) would overcome the disadvantages of chlorination and help reduce the oxygen demand of the wastewater effluent (Chappell et al., 1981). Its main drawbacks are high costs, energy requirements and operational complexity. However, because of the water-quality, safety, odor control, and other benefits to downstream residents, ozone is the disinfectant recommended in the draft facilities plan.

The proposed process of phosphorus removal (lime precipitation followed by sand filtration) is also an effective disinfection technique. In combination with ozone, the anticipated effectiveness of new facilities is expected to be approximately 99 percent or better for bacteria, viruses and pathogens. This is much better than generally accomplished by conventional chlorination, especially for viruses and parasites.

5.4.5 Energy Conservation

All of the available treatment alternatives utilize significant amounts of energy; substantial energy conservation is not practicable if the strict treatment requirements are to be met. The principal technique available for reducing energy use is to cover and/or insulate sensitive facilities so that solar energy is trapped and air/ground cooling does not adversely affect treatment. The draft facilities plan proposes the use of greenhouse structures over the sludge drying beds which would be used in winter; other facilities are expected to function properly without this assistance. A second technique is insulation; the four aeration-chambers would have insulated foundations so that they would not be affected by winter ground cooling. The building housing the filtration, recarbonation and disinfection units would also be insulated.

Except for alternative 12, the draft facilities plan indicates that it is more cost-effective to dry undigested sludge than to digest it; if dried undigested there would be no methane generated at the plant and the energy value of the sludge would be lost.

5.4.6 Flow Reduction

Appendix A.4 outlines existing measures which have already been put into effect to reduce flow; rates of water use in TWSD are low and probably can not be reduced substantially. However, conservation education (as done by the District in the past) is certainly worthwhile since costs are low. Also, two techniques could accomplish such substantial reductions without unacceptable adverse effects. Elimination of the infiltration problem will reduce flow by at least 20,000 gallons. Requirements for the use of dry or extremely low flush toilets in all new construction (and remodeling) would reduce water demand and sewage flow by approximately 33 percent. Specific options for the use of dry or extremely low flush toilets are discussed in Appendix B-5; a scenario for implementing their use is discussed in section 5.4.9.

5.4.7 Control of Non-point Source Pollution

The major sources of non-point source pollution in Twining would be addressed effectively if: a) TWSD implements a comprehensive management program for on-site systems (section 5.4.2); and b) Taos Ski Valley, Inc. and the Forest Service successfully implement programs to control constituents in runoff from fertilized ski trails, the parking lots and disturbed areas. Plans for control of runoff from ski trails and parking lots have been developed and are in the TSV, Inc. 30-year master plan EIS. In addition to these mitigations, site-specific environmental assessments (EAs) will be conducted by the Forest Service prior to development of parking lots and ski trails; the EAs will specifically evaluate runoff-control needs for each project (USFS, 1981a and 1981b). Additional major efforts are not required for purposes of water-quality protection; however, as discussed in section 6.1, the District has the option of taking some additional steps at construction areas.

5.4.8 Rate Design

Table XIII of the draft facilities plan projects the total and monthly costs which TWSD must pay to build a new treatment plant, correct the infiltration problem, and accomplish other necessary wastewater management measures. The table shows that these costs range from $7,000 to over $15,000 per month (for alternative 1), depending on the amount of federal and state funds (if any) which are granted to support facility design and construction.

Based on input from TWSD and the public participation process, the general principal of cost-recovery developed in the draft facilities plan was to design sewer rates so that those who benefit from new facilities would pay for them. In particular, this means that skiers and other visitors should bear the brunt of the expense. Another objective was to sustain an operating reserve fund for emergency use; such a fund reduces the need for special assessments to TWSD members at times when cash may be scarce (e.g. winters with poor ski conditions).

The design developed in the draft facilities plan is as follows.

1. The funds needed per hookup would be estimated on the basis of flow. For example, if federal/state funding provides 50 percent of construction costs and none of the operational costs, TWSD would need to recover about $1.50 per year for each gallon of treatment capacity provided. This equates to about $15/year to provide treatment capacity for each skier (or $15 x 4800 = $64,000/year total) and $75/year for each 'pillow' ($75 x 470 = $110,250). (These numbers are approximate; for comparison, the 1980 budget was $1.08 per gallon per year.)

2. The bulk of this money would be recovered from a surcharge placed on room tariffs and lift tickets. Roughly, this would add 25 cents to the price of each lift ticket and $1.00/night for each overnight guest.

3. The surcharge would fully pay for all TWSD costs (and even produce a surplus for the operating/reserve fund) in a good ski year, but might fall short of providing enough money in off years.

4. New hookups would be sold at market value and the funds added to the operating/reserve fund to assure adequate funding in off years. (If no new hookups are available, costs to existing residents would be greater.)

5. If on-site system maintenance was undertaken, on-site system owners would be charged for services.

6. Finally, property owners would be assessed an annual 'service charge', projected according to the treatment capacity they require as measured by water meters. This assessment would be used to build up the operating/reserve fund in good years; once the fund reached an adequate amount, further assessments would be waived until the fund was depleted.

The proposed rate design appears practical in the context of TWSD's economy. Refer to the draft facilities plan for additional information on the design.

5.4.9 Quality Assurance

A major issue identified in the public participation process was concern that, no matter how good the facilities plan, the wastewater problems in the Rio Hondo will not be resolved. Because of the long history of non-compliance, there is concern by some that TWSD could not (or would not) implement the plan and that EPA, EID and/or USFS could not (or would not) enforce compliance with the regulations. While it may not be possible to eliminate all sources of human and mechanical error, it is possible to reduce the risks of non-compliance to a minimum; this is the concept of quality assurance.

Quality assurance alternatives fall into three broad categories: technology; TWSD management; and government enforcement. The concept of a hookup policy is a sub-category of TWSD management and has been a topic of particular public interest. As background to part of the discussion, it is useful to examine the nationwide experience of municipal wastewater facilities. As described in many references (e.g. Hadeed, 1981; Feliciano, 1980; Nordlinger, 1980) the history of Twining is not unusual; in fact, more municipal plants are in violation of their NPDES permits than are in compliance. Causes of this problem include (but are not limited to): 1) inadequate design capacity; 2) equipment deficiencies; 3) unsolved infiltration/inflow problems; and 4) operation and maintenance deficiencies.

Technology. Although many agencies are involved in the design and construction process, the owner may have no one to turn to if a completed plant has problems. Thus, it is important that plans and details be carefully reviewed prior to final approval (Feliciano, 1980). A special type of intensive review, designed for the purpose of quality assurance and cost-control, is value engineering. Specialized consultants review project plans and designs prior to construction to verify that the processes used will work as intended and that the treatment system is fully cost-effective. Value engineering is not a routine part of all facilities plans, but can be included in the step 2 grant program where appropriate.

Special EPA review programs exist which deal with the construction and operation stages. Implementation of these would document and provide a positive demonstration of proper performance on the part of TWSD and its agents. Such extra steps toward quality control - if successfully accomplished in an open forum - would help reverse the long-standing antagonism between the resort and downstream residents. As one specific requirement (others can be identified during design) for the construction phase, the grantee must hire a competent resident inspector; in addition, the Corps of Engineers makes periodic inspections. Inspection requirements are particularly appropriate for a situation such as Twining, where the grantee lacks in-house technical/engineering expertise. Had such assistance been available in the past, many of the existing problems might not have occurred.

Assuming a facilities plan is well-conceived, value engineering should refine but not drastically alter the system design. To help judge whether or not the proposed alternatives are likely to work, the EIS research has included a survey of wastewater treatment technology in Alaska (Johnson, 1978) which emphasized the following as being appropriate or reliable cold climate technology: the use of lime for disinfection; use of waste heat for sludge drying; modular designs for fluctuating populations; the use of surge tanks or equalization basins to steady the loading rate and thereby improve treatment; the use of the extended aeration process as a consistently reliable method; and an emphasis on good operation and maintenance. All of the these, except using waste heat for sludge drying, are key parts of the TWSD draft facilities plan. (It was determined that there would not be enough waste heat from sources such as sludge pumps to be used beyond helping to heat the main building.)

Similarly, a review of phosphorus removal technology by the U.S. Army (Ryczak and Miller, 1977) recommended chemical removal as the most flexible, consistent, reliable and economical method, which also provides for higher suspended solids removal. The report also notes lime to be especially appropriate for use with low alkalinity waters such as the Rio Hondo. Thus, the proposed facilities are consistent with the best available technology for phosphorus removal.

The same conclusion applies to the disinfection methods. The literature cites ozone as a powerful oxidizing agent, second only to fluorine (Rabosky, 1972; Heckroth, 1974). It will react rapidly with almost any oxidizable compound and has the potential to reduce BOD, COD, turbidity, color, odor, taste, refractory organics, bacteria, and virus levels. In water ozone decomposes to form molecular oxygen, adding to dissolved oxygen levels. Ozone is more effective than chlorine in removing or reducing odors from wastewater and has been found to be very effective in removing airborne odors, even more so than activated carbon filters, chemical masking agents, or organic chemical deodorants. However, the presence of suspended organic materials in the wastewater can be an obstacle to highly efficient ozone disinfection, and it may be difficult to treat secondary effluent with ozone and consistently meet bacteriological standards. Therefore, either longer contact periods or prior tertiary treatment, such as filtration, may be necessary. The draft facilities plan proposes that filtration precede ozonation.

TWSD Management. Inadequate provisions for operation and maintenance (O&M) are commonly cited as problems leading to non-compliance by treatment plants. Specific problems can include lack of trained personnel, lack of routine maintenance, insufficient laboratory equipment, an inadequate spare parts inventory and an inadequate budget. All of these problems have occurred in Twining in the past (see Appendix A.4) and all have been addressed to some degree in response to past enforcement actions (see Appendices A.1 and A.2). Specifically, the District has retained the services of a full-time Class IV operator - the highest rating - though State regulations only require a Class III operator for Twining. (The District also has a full-time Class III operator and a full-time administrative assistant.) The District doubled its budget from 1979 to 1980, purchased a 100 percent spare parts inventory and has equipment adequate for full self-monitoring. As a result, routine and remedial maintenance activities have increased significantly (see Appendix A-2).

All of these O&M improvements go a long way towards insuring a more consistent high quality effluent. The NPDES permit provides the principle incentive for proper O&M in the future (see subsequent discussion of enforcement).

Hookup policy. Any policy which TWSD may adopt toward the granting of new hookups is of major interest because it appears that the demand for hookups will exceed supply; thus the allocation of hookups may determine the costs of new high-density development. Of equal importance, because of the history of non-compliance of the present facility there is a need to ensure that any new plant is not overloaded and rendered ineffective.

The existing hookup policy may be termed a conditional moratorium, where hookup is not considered unless pretreatment is provided and the TWSD plant already is in compliance with the regulations. Due to past difficulties in meeting its effluent limitations, the District wishes to maintain a peak average weekly inflow of 80,000 gpd as untreated wastewater (this peak was recorded in 1980). As plant hydraulic capacity is 100,000 gpd, this leaves 20,000 gpd of unused hydraulic capacity. Thus, the plant can convey (not treat) another 20,000 gpd, and if a customer wishes to discharge treated wastewater to the sewer system, and if plant performance is stable and reliable, the District will accept it. Wastewater must be pretreated to 30 mg/l BOD and SS, which are the key NPDES limitations (see Table 4-1).

Under the existing policy, if the TWSD plant is not in complete, reliable compliance with effluent regulations then those who need wastewater service can construct their own independent treatment facility if such facility produces water of potable quality (i.e. plants similar to treatment alternative 13). If such a facility is approved by appropriate state and federal agencies, it will be accepted by the District.

The effects of the policy can be illustrated by the case of Ski Solar Homes of Albuquerque which has proposed an 18-unit condominium development for the base area of the resort. Initially the developer stated his intention to discharge 3,600 gpd of pretreated effluent to the District. Solar Ski's notice was accepted by EID (EID, 1981c) and the District initially approved it subject to receipt of the acceptable design information (TWSD, 1981), and with the understanding that service would be stopped if pretreatment is inadequate or flows exceed 3,600 gpd. In effect, TWSD offered Solar Ski Homes the use of its effluent pipe for discharge of already treated wastewater to the Rio Hondo.

However, because of violation of the effluent standards in the spring of 1981, and reflecting considerable public concern, TWSD deemed that its plant performance, although much improved, is not yet reliable and stable and decided to deny the new hookups at this time. In response, Ski Solar Homes proposes to construct an independent treatment plant which would produce potable water; the effluent from the plant would be discharged to the ground water through an injection well. This concept resembles treatment alternative 13, discussed in section 5.2. Such an approach would comply with the District policy and is not in any apparent conflict with state and federal regulations; there would be essentially no pollution of the ground water or river flows. Although the proliferation of independent facilities may comply with applicable requirements, there could be significant disadvantages including reduced reliability due to the existence of many different plants of relatively sophisticated design and the substantial increase in the total costs of wastewater treatment within Twining (thus the increase in the use of energy and other resources).

The plans of Solar Ski Taos reinforce the point made with respect to Table 5-6, that an 80,000 gpd plant is not a no-growth facility. If the District should limit its plant size to 80,000 gpd there would be at least 15,000 gpd of wasteload allocation available in the Rio Hondo and it can be expected that independent plants would be constructed to utilize that allocation. Should such facilities all use very advanced (and expensive) treatment technology, it would be possible for the Twining area to grow subsantially (i.e. to a population equivalent of 150,000 gpd or more) without coming into conflict with water-quality regulations.

Future hookup alternatives available to the District, following construction of a new plant, include: 1) continuing the present policy, or 2) allowing hookups on some type of phased basis. Legal factors may play a role in this decision, since property owners might well challenge any moratorium that does not have a sound technical and legal basis. The existing basis is:

the plant has been unable to meet effluent limitations and stream standards at present flows, is under a legal agreement to do so, and until it can, no new wastewater should be introduced to the system. Once the improvements are made and the TWSD is in full compliance, it is uncertain if the District could unequivocally ban new hookups. However, some type of phased or conditional moratorium might be imposed which would restrict or deny hookups during the period when phosphorus removal capabilities are being demonstrated. If the policy were clearly for 'health and sanitary purposes' it is arguable that it could be within the legal authority of the District.

The District is currently evaluating criteria for determining eligibility for future tie-ons. Three major alternatives have been suggested. The first is a possible scenario for phasing hookups; it attempts to reflect a balance of the concerns of persons throughout the Rio Hondo watershed and is a compromise between fast-growth and no-growth philosophies.

1. The District proceeds to construct phosphorus treatment facilities capable of treating 80,000 gpd or 95,000 gpd. This must be done in conjunction with resolution of the existing infiltration problem.

2. The District, EID and the Forest Service cooperate in setting up methods for continuing to monitor stream conditions (example: monitor non-point sources). If water rights are transferred, the evaluation of low-flow conditions would be reviewed.

3. Additional water conservation efforts are made to reduce sewer flows (for example, dry or extremely low flush toilets are required in all new construction).

4. Once the plant is built, the District demonstrates that an effluent quality of 1 mg/l phosphorus or better can be accomplished. This would be demonstrated over some as yet undefined time period, sufficient to prove reliability under varying conditions. The monitoring shows that there is no major reason to change the wasteload allocations. (That is, the values of flow, background pollution, etc. used originally still apply. Note that if monitoring shows problems in this regard, there could be a need for a continued hookup moratorium.)

5. The District extends service lines to its top priority customers - existing properties presently experiencing problems (Kandahar and selected cabins).

6. Step 4 is repeated.

7. Additional hookups are allowed, first for expansion of existing development and then to new facilities. These would be allocated in an as yet undefined amount and schedule, in phases, with step 4 repeated as necessary until the design capacity of 95,000 gpd is reached. If the original plant is 80,000 gpd, this would require some physical modifications at the plant.

8. Step 7 is repeated and capacity expanded so long as the wasteload allocations demonstrate a virtually zero risk that the stream standards would be violated.

To summarize, any development resulting from a 95,000 gpd NPDES limit would be phased in based on plant performance, providing a positive incentive for good management on the part of TWSD. The capacity of the plant (and the number of hookups allowed) would depend on the continued verification of the numbers used in the wasteload allocation (see Appendix B.4), plus the ability of the District to produce a clean effluent. Expansion beyond 95,000 gpd could follow the same strategy except, as noted in section 5.3.2, TWSD would have the added responsibility of determining that the wasteload allocation calculations can be revised without violation of the standards. Some members of the public have suggested that plant design receive a value engineering analysis prior to approval and implementation.

The alternatives are a slow-growth or fast-growth hookup policy. Under the slow-growth alternative, TWSD would deny all new hookups until the District is in full and complete compliance with its NPDES permit for some period. This approach is favored by some downstream residents. The fast-growth alternative would lift limits on hookups once a new plant is in place; new connections would be sold on the open market to pay off construction costs. This option has been suggested by some District residents, especially if federal funding is not available for a new facility.

Regardless of the hookup policy adopted by the District, developers with sufficient economic incentive would be able to construct independent treatment plants with a ground water discharge (as demonstrated by the case of Ski Solar Homes).

Enforcement. At the scoping meeting in October, 1979, and in public meetings since then, considerable public concern has been expressed about the perceived lack of vigorous enforcement of federal and state laws which, on paper, should have prevented the pollution of the Rio Hondo by the Twining Water and Sanitation District. Citizens ask whether there is any reason to believe the future will be better.

The following discussion details enforcement history and current enforcement policies. It is important to note that any decision on enforcement actions in the future must be based on all relevant facts and policies in effect at the time.

U.S. Forest Service. USFS and EPA have agreed that since EPA is the federal agency responsible for water-pollution control, EPA should take the lead in enforcing any federal water-quality requirements which apply to Twining. This policy is not likely to change in the future.

U.S. Environmental Protection Agency. EPA issued the NPDES permit that regulates the discharges from the Twining plant. EPA is responsible for enforcing the permit; enforcement options include letters, administrative orders and referrals to the Department of Justice. In 1976, EPA issued Twining an administrative order for permit violations. The order required Twining to take several actions in order to remedy problems at the treatment plant. Hindsight reveals that, while the actions taken improved plant performance somewhat, they were not adequate to eliminate the non-compliance (as evidenced by continued pollution after Twining complied with the order).

In the Clean Water Act, Congress gave EPA two ways (sometimes combined) to solve pollution problems caused by publicly-owned treatment works (POTWs): grant funds and enforcement authority. This has produced a 'carrot-and-stick' approach to pollution problems. EPA has emphasized the carrot (prioritized construction grant funds), resorting to enforcement against municipalities (or sanitation districts) only when the preferred approach does not succeed. Because the amount of construction grant funds is limited compared to the demand, EPA's reliance on the funding approach has resulted in some delay in eliminating municipal non-compliance. This delay is illustrated by the fact that, as of July 1, 1977, sixty percent (10,251 of 17,218) of POTWs were out of compliance with some part of their permits (Feliciano, 1980). Congress amended the law in 1977 and provided to qualified POTWs extensions of the deadline by which secondary treatment must be provided.

EPA believes that state governments can identify problems and initiate enforcement actions. Thus, EPA's relatively small enforcement staff works primarily on major problems which are of national or regional concern (for example, the Houston Ship Channel in Region VI), or those which are brought to EPA's attention by the states and which warrant federal attention.

In 1979, EPA announced a new policy dealing with municipal non-compliance, as articulated in "The National Municipal Policy and Strategy, October, 1979" (EPA, 1979b). The policy was partly in response to changes in the federal law, changes made because so many plants were not able to meet the original pollution clean-up schedule in the law. EPA understood two options. First, the agency could issue a permit to a discharger if it looks as though the plant could meet final permit requirements by July 1, 1983. EPA would set both interim and final effluent limitations in the permit and would specify a construction schedule with milestone dates. These milestone dates would provide a check on progress; failure to meet the schedule would be grounds for an enforcement action. For Twining, interim effluent limitations proposed would be similar to those imposed by EID in the "Assurance of Discontinuance" (refer to Appendix A.1 and Table 4-1). The final limit would reflect the need to remove phosphorus from the wastewater in order to comply with the proposed revisions to the state water-quality standards (see Table 4-1).

Second, if it appears that final permit limits would not be met by July 1, 1983, EPA could issue an administrative order in conjunction with issuance of the NPDES permit. The administrative order would set up a milestone schedule, which would be followed until 1983 and would also contain interim effluent limitations. At this time, the schedule for completion of the Twining facility has not been established. Should design begin before the end of 1981, compliance with the permit may be possible by July 1, 1983. If so, a permit with interim and final limits and a construction schedule would be issued. Otherwise, the administrative order would govern, with its own schedule for compliance.

The formalized policy incorporates specific milestone schedules, which should better define when the carrot approach is not working and enforcement action is needed. Specifically, once new facilities are in operation (or once the grant process has been terminated), there should no longer be any basis for any entity to cite 'work in progress' as a basis for deferring action.

New Mexico Environmental Improvement Division. EID has historically relied upon EPA to correct pollution problems through the construction grants program or through enforcement actions against municipal permit-holders (including sanitation districts). States have the option of taking control over permits of the type which are issued to Twining (subject to EPA review), through delegation of the NPDES permit program from EPA. The New Mexico legislature has chosen not to exercise this option. Therefore EID has taken the position that full responsibility for the permit program remains with EPA. Further, until April 1979 the agency was unsure as to whether the federal law took precedence over state regulations (Pierce, 1980). The State took no actions against any municipal discharge regulated by a federal permit prior to 1979, leaving all enforcement to EPA.

In April, 1979, EID reassessed the legal relationship between federal and state law, and determined that the existence of a federal permit did not preclude enforcement of state regulations (Pierce, 1980). Problems at Twining were addressed soon after the new policy took effect. The initial result of state actions, the Assurance of Discontinuance, is discussed in Appendix A. The violations in early 1981 have led to enforcement actions by the agency: a complaint against TWSD was filed by the New Mexico Water Quality Control Commission (NMWQCC). In response to this action, both parties entered into a Judgment by Consent, which represents an agreement between NMWQCC and TWSD. Under the terms of the Judgment, the District agreed to pay a penalty of $500 and to expend $3,000 on improvements to the plant. The District also agreed to sample for BOD and fecal coliforms on a weekly basis (Saturday or Sunday during the ski season). Results from these samples can be used for enforcement action under the terms of the Assurance, which remains in effect. Failure to meet the terms of the judgment amounts to contempt of Court.

EID enforcement activity reflects a revised policy on EID-EPA relationships. So long as the new policy remains in effect (and subject to limitations in resources), EID is likely to continue to be relatively aggressive in enforcement activities. However, once Twining complies with the Assurance of Discontinuance, EID (like EPA) would rely upon the construction grants process and milestone schedules before taking further action (Pierce, 1981).

TWSD. The Sanitation District (and its predecessors) have generally followed a reactive approach to the pollution problem. That is, most steps taken by the District have occurred in response to incentives and directions from EPA and/or EID. For example, major modifications to the treatment plant and/or operation of the sewer system have occurred in reaction to EPA's Administrative Order and the Assurance of Discontinuance negotiated with EID. In recent years, the District has looked to the construction grants program as the principal approach to providing a long-term solution to its contribution to the pollution problems of the Rio Hondo.

Citizen Action. Action by area residents has played an important role in past enforcement; for example the Committee to Save the Rio Hondo (see chapter 7) was a party to the Assurance of Discontinuance. In the same vein, the Committee has indicated its willingness to use appropriate legal remedies with regard to current and future decisions of the U.S. Forest Service, EPA, EID, TWSD and others. The committee has notified EPA and TWSD of its intent to initiate legal action under the Citizens Suit provision of the Clean Water Act 'to obtain prompt and complete enforcement' of the TWSD NPDES permit.

Summary of Enforcement Issue. Until 1979, all the agencies concerned with pollution problems at Twining have viewed EPA's construction grants program as the primary means for resolving pollution problems in the Rio Hondo. In accordance with its National Municipal Policy and Strategy, EPA gives eligible municipalities extensions for complying with the treatment requirements of the Clean Water Act. These municipalities are placed under enforceable compliance schedules. After the construction grants process is completed, the municipalities must comply with the final limit of its NPDES permit.

EID has followed a relatively strong enforcement policy since 1979, one which has already resulted in significant reduction of organic matter and bacterial pollution in the Rio Hondo. It also looks to some type of compliance schedule for resolution of remaining problems.

In conjunction with issuance of a NPDES permit, which would include final effluent limitations for phosphorus, EPA will probably establish a strict timetable for completion of the construction grants process. Failure to meet the timetable would be grounds for enforcement actions. EID has the option to take enforcement action for violation of state regulations.

The District will be responsible for self-monitoring, a job it can now do due to its new staffing and laboratory equipment. Since late April, 1981, the District has done self-monitoring analyses at Twining. In addition, they may send samples on an infrequent basis (about once a month) to the State Labs, in order to obtain a double-check on their own analyses. The State will check the District's results and do quarterly sampling on its own for any indication of violated stream standards and for violations of the NPDES permit. If violations of the NPDES permit or state regulations are documented, EPA or EID could take enforcement acton.

Continued Public Participation. The District has the alternative of continuing the involvement of the public in the wastewater planning, construction and operation process. Public awareness of District plans could help avoid future misunderstandings and could, solely by keeping people informed, transform suspicion into productive interest. The mechanisms for such participation remain to be examined, but could be as simple as posting public notices about all EPA, District, EID, and USFS actions (newspaper releases plus use of a mailing list), and providing some basis for open discussion of those actions which have an impact outside Twining.

5.4.10 Administrative Measures

Federal regulations for EPA funded wastewater treatment projects require the District to adopt a sewer use ordinance prohibiting certain discharges and establishing the requirements for new sewers and connections, and a user charge system and schedule based on flows and wasteloads. These ordinances would deal with issues discussed previously: hookup policies; flow reduction measures; rate design. In addition, the sewer use ordinance could continue the existing practice which bans the use (discharge) of phosphorus detergents (see Appendix A.4). In general, TWSD has very substantial powers to ensure effective wastewater management and appropriate water use (both public and private) throughout the District.

Additional administrative steps have been suggested during the public participation process, as for example, requests that the resort community establish an equal opportunity program and limit water rights purchases to areas with priority rights (Arroyo Hondo). Some of these suggestions are outside the scope of the powers of a Sanitation District; others represent TWSD policies not directly related to wastewater. The public participation process (including the public hearing on the DEIS) provides a forum for specific recommendations which, if within their powers, may be considered by the TWSD Board.

5.5 APPLICANT'S PREFERRED ALTERNATIVE

The District (TWSD, 1981a) has stated its preferred alternative as building a new plant of conventional design (alternative 1, Table 5-1) at the existing site with a peak average weekly capacity of 95,000 gallons per day (alternative E, Table 5-5). The District feels this plant would function reliably under the variety of flow conditions experienced in Twining, and would be easy to maintain. An aquaculture plant was noted as being appealing but not an adequately proven technology considering the climatic extremes of Twining.

The District feels that 95,000 gpd is necessary to accommodate a minimal amount of the expected growth. Approval of new hookups would depend upon performance of the new plant.

The District intends to review its decision in light of discussions presented in the Draft EIS; this document will also be used as input to the selection of other alternatives (e.g. approach to OSS management, flow reduction, rate design and quality assurance).

At this time the Citizens Advisory Committee (see chapter 7) has made no recommendation to the District with regard to the preferred process and capacity alternatives. Lack of consensus reflects the debate described in section 5.3.

PART B. ALTERNATIVES AVAILABLE TO EPA

Region VI of EPA has several options with regard to the funding of the most cost-effective alternative (which may or may not be TWSD's preferred alternative).

1. EPA may decide to provide no funds for any TWSD project.

2. EPA may fund some percentage of the eligible portions of a project which will treat only existing flows (this could be chosen even if a larger plant is determined to be most cost-effective).

3. EPA may fund some percentage of the eligible portions of a project which provides some capacity to treat expanded flows in the future; this could be the District's preferred capacity or another capacity.

4. EPA may attach conditions to any grant awarded to the District.

Upon completion of the facilities plan and public review of this Draft EIS, EPA will have the technical information and the public input to evaluate the situation in Twining and the impacts of each option. At that time EPA will identify its preferred course of action. EPA recognizes that its decision has both a practical and symbolic impact on the growth debate described in sections 5.3.3 and 5.3.4. As a practical matter, a decision to fund an expanded facility will make it more economically feasible to develop in Twining and thus may encourage growth (or at least have some influence on the timing and form of development). However, a decision of funding for no-growth would not prevent TWSD from implementing its preferred alternative; rather, it would require that the District incur all of the costs of growth. Similarly, a decision to provide no further federal funds to TWSD would not relieve the District of its obligation to make improvements to the treatment plant sufficient to meet NPDES requirements.

If funding is limited to 80,000 gpd plant the costs of any expansion would be fully borne by the District and by those who benefit from development in Twining. If funding is severely limited (or denied entirely), members of the District expect that to make up for lost government funds there would be a need to raise revenue locally through the sale of hookups, thus resulting in more rapid expansion of the plant than would occur from the hookup policies described previously (Stagg, 1981a). Alternatively, if the District cannot fund plant expansion, there may be additional construction of independent plants of the type now proposed by Ski Solar Homes. In either case, costs of growth would be borne by those who most directly benefit. To the extent that federal funds now targetted for Twining are not allocated to the District, such funds would become available for construction grants awarded to other municipalities on the New Mexico priority list.

EPA will take growth impacts into account in making its decision; however, many other agency policies and regulations will bear on that decision. EPA cannot and will not impose a land use planning mandate on Taos County; the agency's decision is not intended to provide either practical or symbolic guidance on how Taos citizens should plan their future.

PART C. ALTERNATIVES AVAILABLE TO OTHER AGENCIES

The EID has funding alternatives similar to those available to EPA, as well as enforcement options discussed in section 5.4.9. The agency has a mandated responsibility to monitor the water quality and ecology of the Rio Hondo (in conjunction with the U.S. Forest Service), including specifically non-point sources. EID and USFS also intend to establish air quality monitoring (USFS, 1981a and 1981b).

Alternatives with respect to ski trails, parking and related facilities were developed and evaluated by the U.S. Forest Service (USFS, 1981a and 1981b); see Table 6-6 of this document. In general, the USFS decision approved the proposed facilities with some modifications to reduce stresses on the existing wastewater treatment plant. A skier limit of 4800 per day was approved subject to compliance with water-quality regulations. In addition, an interim skier limitation of 4050 per day was approved until such time that sewage problems have been resolved.

The U.S. Forest Service will face specific decisions with respect to amending the TWSD special permit, in the event an additional acre of land is required for an expanded treatment plant. The agency normally utilizes an environmental assessment to define mitigation measures for site-specific construction impacts. Also, USFS has the responsibility for implementing or overseeing a wide range of measures to control non-point source pollution from the trails, parking lots and other facilities at TSV, Inc. and is undertaking an evaluation of alternatives for increasing the water yield of the drainage basin (USFS, 1981a and 1981b).

The general authority of agencies identified in section 3.3 is one of independent action, outside the scope of the facilities plan and EIS. As one example, the Forest Service can address at least some of the regional environmental problems in its ongoing forest plan for Carson National Forest; similarly, the County of Taos can assert extensive control over land use in the Hondo Valley (and elsewhere) if and when it undertakes and adopts a countywide land use plan and zoning ordinance.

CHAPTER 6

ENVIRONMENTAL CONSEQUENCES OF ALTERNATIVES

6. ENVIRONMENTAL CONSEQUENCES OF ALTERNATIVES

Chapter 5 characterizes the major environmental impacts of the alternatives. Chapter 6 contains information in support of the impact evaluations. Three types of information are provided: a description of the existing conditions; explanations of any of the impact evaluations which were too complex to present fully in chapter 5; and a summary of the beneficial and adverse impacts which could result from different alternatives. Chapter 6 contains eight sections. The first seven sections concern individual environmental components, as follows: earth resources (6.1), water resources (6.2), air and sound quality (6.3), biological resources (6.4), archaeological, historical, and other sensitive resources (6.5), socio-economics and land use (6.6), energy and other resources (6.7). Each of these sections is subdivided and considers, in turn, existing conditions, impacts of the no-action alternative, impacts of treatment alternatives, impacts of capacity alternatives, impacts of other alternatives (e.g. on-site system management, flow reduction, rate design, quality assurance); and impacts of EPA and other agency alternatives. Section 6.8 summarizes adverse impacts which cannot be avoided, the tradeoff between short and long-term uses of the environment, and irreversible and irretrievable commitments of resources.

To help make the EIS a concise and useful document, the level of detail is consistent with the decisions which must be made by TWSD, EPA and others, as follows.

- Descriptions of each environmental component are generally brief with the exception of sections 6.2 (water) and 6.6 (socio-economics), which are the principal subjects which bear on prospective decisions and which relate to issues identified as significant in the environmental review process.

- The no-action alternative cannot be accepted because it fails to meet mandatory water-quality objectives; therefore, impacts of this option are presented in summary.

- Regarding treatment alternatives, several environmental issues were critical to decision-making and are explained in detail (for example, the water-quality impacts of snowmaking or the water-supply impacts of regional alternatives). However, in many respects the environmental analysis shows no major difference between treatment plants; in such cases the impacts are presented in summary.

- The major impacts of capacity alternatives can be identified by discussion of alternatives B (80,000 gpd) and E (95,000 gpd), while the effects of other options can be summarized through comparisons to these two alternatives. The assessment focuses on broad issues of growth policy and community perceptions about prospective development. The growth analysis considers expansion of Twining as a winter resort, with some small, related growth in summer use. Should Twining become a major summer resort, impacts could be much greater than presented here.

- In general, alternatives presented in section 5.4 are intended to improve the wastewater management system; some have no major environmental impacts while others have special benefits. The discussions in chapter 6 summarize such benefits and are expanded only when there is a particular environmental consideration which may influence decision-making (for example, the water-quality and safety benefits of ozone, which may justify the higher dollar cost of this approach to disinfection).

- The main decision facing EPA and other agencies is the approval/funding of specific treatment and capacity alternatives. The impacts of these decisions are described in the specific sections on treatment and capacity alternatives and are not repeated in detail in the section on agency alternatives.

6.1 EARTH RESOURCES

Earth resources include terrain, climate, geology and soils.

6.1.1 Existing Conditions

Terrain. Twining is situated in the Sangre de Cristo Mountains near the head of the Rio Hondo drainage basin (see Figures 3-1, 4-1, 5-1). Terrain is among the most rugged in New Mexico, consisting primarily of steep mountain slopes and deep canyons. Numerous live streams exist throughout the area. A very limited amount of moderately sloping bottom land exists along the river. Elevations range from about 9300-9400 feet in Twining to 13,161 feet atop Wheeler Peak (the highest mountain in New Mexico).

The North and Lake Forks of the Rio Hondo join in the Twining base area to form the main river. The Lake Fork is the larger stream; it descends northward from Wheeler Peak in a bowl-shaped valley which is less than 1,000 feet wide. The narrower North Fork enters the main valley from the northeast.

From Twining to Valdez (a distance of 8 miles) the river generally flows in a narrow, steep-sided canyon, although it widens somewhat near Amizette (see Figure 5-1). The drainage area above the mountain front is 36 square miles; the elevation at this point is about 7650 feet. From Valdez to the Rio Grande (9 miles) the river is cut into the broad, sloping piedmont surface which adjoins the mountains. Near Valdez and Arroyo Hondo the entrenched valley is relatively wide, while elsewhere it is a small but narrow canyon. The Rio Hondo joins the Rio Grande at Dunn Bridge; the drainage area at this point is 76 square miles, and the elevation is about 6500 feet.

Figure 5-1 illustrates the steep terrain within the Twining Water and Sanitation District (TWSD). Slopes range from five percent in the lower village to over forty percent on the valley sides. Most commercial establishments are in the lower village on moderately sloping hard ground. Most condominiums and cabins are either east of Lake Fork Creek on steep, rocky mountainsides, or are adjacent to Lake Fork. Steep slopes increase construction costs but generally have not limited development.

Climate. A detailed description of Taos County's climate is available in Wilson (1978). Precipitation is highly variable, and in the Twining area averages 30-35 inches per year, about half of which occurs as summer thunderstorms. Annual snowfall is 100-200 inches, equivalent to 40-45 percent of the annual precipitation. Temperatures range from 30°F to 80°F in summer and from -25°F to +45°F in winter. The frost-free season is normally less than three months. Sunshine is plentiful, averaging 3,000 hours a year, or 70 percent of the possible hours; measured radiation is nearly 90 percent of that which would occur under continuously clear skies. Winds tend to be channeled along the valley, moving up slope as the ground warms in the morning, then down slope as the ground cools at night. Due to the mountainous terrain, there is essentially no potential for local temperature inversions.

Geology. The geology of the area is complex. In the mountains the bedrock is dominated by fractured crystalline rocks such as granite and quartzite. The valley bottom contains thin, highly variable alluvial sediments deposited by the present-day stream and/or by Pleistocene glacial meltwaters. Schilling (1960) contains a detailed geologic map of the Twining area; see also Brown (1971). Mineral resources (mainly gold and copper) occur in or near TWSD, in the Rio Hondo Mining District; the most recent activity was in 1956 at the Frazer Copper Mine east of TWSD (Schilling, 1960). Because of the low grade of the ore, there is apparently no active interest in the near-term development of these resources.

Underlying the mountains west of the area is a sequence of alternating lava flows and alluvial or lake sediments, all of late Cenozoic age. Young alluvium occurs throughout the wider portions of the Hondo Valley. For more information on the geology of the lowlands refer to Wilson (1978).

Soils. Detailed soils data are available from USFS (1971). Soils in the Twining area are mostly coarse to rocky in texture and tend to be acidic. The soils are loamy on sloping areas and alluvial in drainageways. Rock outcrops are common. Figure 6-1 locates the major soil types and slopes. Soils occuring adjacent to drainageways are of the Cryoborolls subseries (mapped as CSC) or of the Presa-Cryaquolls Association (PYF). These soils are mixed alluvium up to five feet deep and are slowly to moderately permeable; water will be readily transmitted through the substrata or underlying bedrock. Shallow water tables create problems for pipe laying, foundations and on-site systems.

Adjacent to the valley soils, on steeper slopes, is a Marosa-rock outcrop-rhyolite complex. Sixty percent of this unit is a cobbly loam; the rest is steeper and consists of granite/rhyolite stoney land. Permeability is moderate and the underlying substratum or bedrock is relatively impermeable, resulting in seeps and springs being common. Steep slopes result in a high

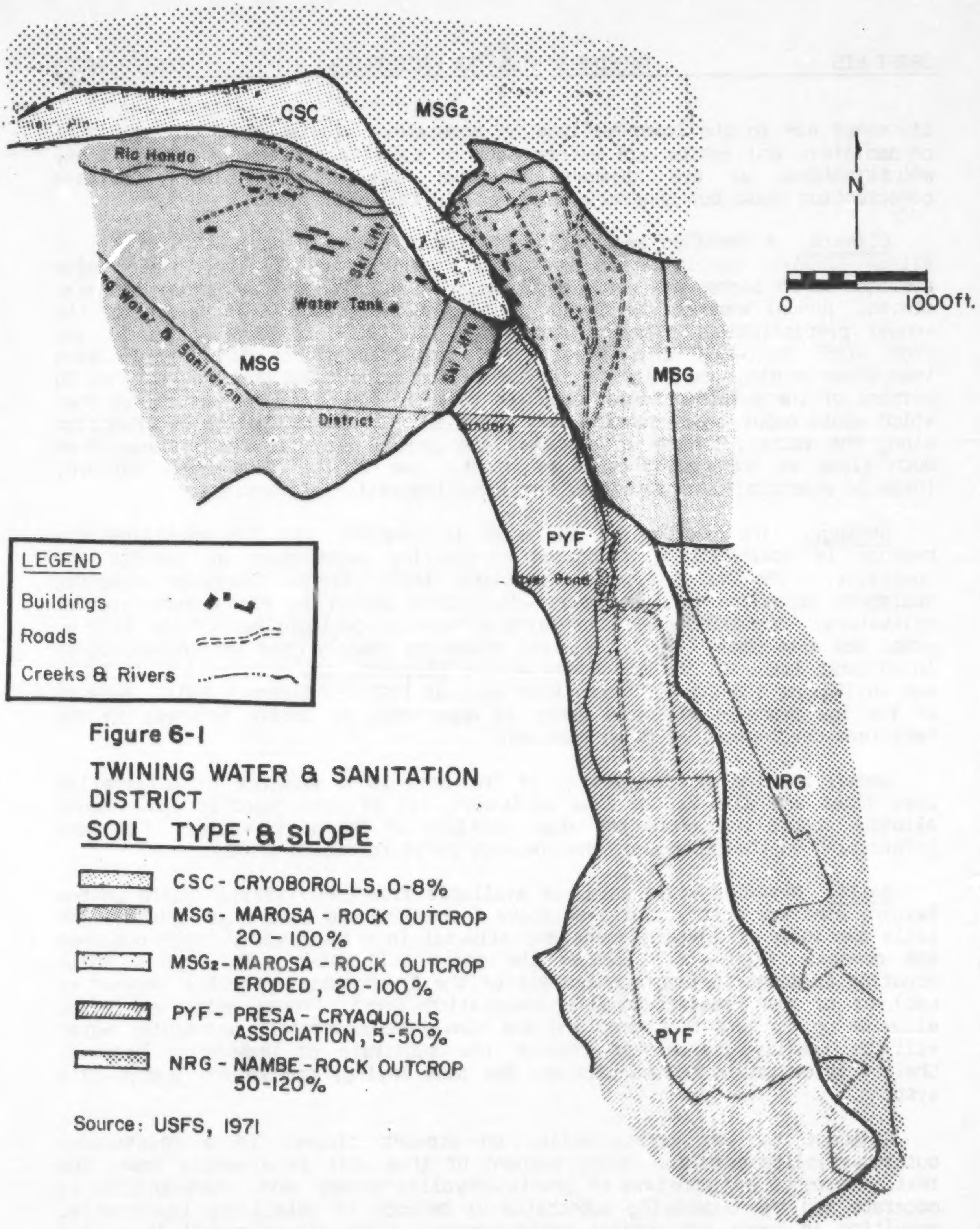


Figure 6-1

TWINING WATER & SANITATION DISTRICT

SOIL TYPE & SLOPE

- CSC - CRYOBOROLLS, 0-8%
- MSG - MAROSA - ROCK OUTCROP 20 - 100%
- MSG₂ - MAROSA - ROCK OUTCROP ERODED, 20-100%
- PYF - PRESA - CRYAQUOLLS ASSOCIATION, 5-50%
- NRG - NAMBE - ROCK OUTCROP 50-120%

Source: USFS, 1971

potential for erosion if vegetative cover or litter is removed, and they present a difficult environment for construction.

Erosion rates in the Twining area are generally less than two tons per acre except in disturbed areas (USFS, 1969, 1981a and 1981b). Disturbed areas include the following:

- burned-over areas, principally at the head of East Gavilan Canyon, which contains shallow, rocky, highly erodible soils in which some gullying has occured;

- graded areas, such as the Twining base area, which erode at rates of up to five tons per acre depending on slope, revegetation and other factors;

- road cuts along the Hondo Canyon, where steep canyon walls slide or fall onto the road (especially during freeze-thaw periods) and cause debris to move directly into the river; road grading contributes to the transport of material to the stream.

Stream turbidity is adversely affected by all these sources of sediment. However, the available data (see Table 6-2 and Figure 6-3) indicate no major turbidity problems in the river; thus, the effects of erosion are probably episodic rather than chronic.

Revegetation is one means of controlling erosion and is practiced on new ski trails. Deficient levels of nitrogen and phosphorus have been identified frequently in the affected soils, and fertilization with these two elements has been a common practice. Application rates by Taos Ski Valley, Incorporated (TSV, Inc.) have been approximately 600 pounds per acre of 16-20-0 fertilizer (USFS, 1981a and 1981b).

6.1.2 Impacts of the No-Action Alternative

There would be no new impacts on earth resources under the no-action alternative, except those which may occur as a result of the TSV, Inc. master plan which is evaluated in a separate EIS (USFS, 1981a and 1981b) and which may occur from cabin construction (see section 6.1.4). Mitigation measures to minimize impacts on earth sources are discussed in the master plan EIS. Cabin construction would occur on private land, and so impacts from this source may be largely uncontrolled.

6.1.3 Impacts of Treatment Alternatives

Most regional alternatives would involve major construction impacts at new plant sites and along pipeline routes; several hundred acres would be affected by implementation of alternatives 6, 7, 8, 10, or 11. Table 6-1 characterizes these impacts, including effects on soils, terrain, air quality and geology.

TABLE 6-1. ENVIRONMENTAL IMPACTS OF CONSTRUCTION ACTIVITIES.

*Indicates effects which may be long-term.

CONSTRUCTION ACTIVITIES	IMPACTS
I. Sewer construction	
A. Obtaining easements and rights-of-way*	Change in land values; change in land use
B. Site clearing/construction of access roads*	Surface change; vegetation change; soil removal and disturbance; change in visual quality; waste disposal; equipment operation; traffic rerouting; possible archaeological and historic site disturbance
C. Trench excavation, pipe laying, and trench backfill	Surface change; soil removal and disturbance; change in visual quality; dewatering; blasting; equipment operation; traffic rerouting; possible archaeological and historic disturbance; utility disruption or relocation
D. Site restoration*	Surface change; vegetation change; change in visual quality; waste disposal; equipment operation; traffic rerouting
E. Other activities	
1. Onsite storage of equipment, pipe, excavated soil	Surface change; change in visual quality
2. Equipment travel to and from site	Equipment operation; traffic rerouting
3. Security and safety	Surface change; change in visual quality; traffic rerouting
4. Support activities (dust control)	Change in visual quality; soil treatment; equipment operation
II. Sewage treatment plant construction	
A. Obtaining easements, rights-of-way, and acquiring site*	Change in land values; change in land use;
B. Site clearing and access roads*	Surface change; vegetation change; soil removal and disturbance; change in visual quality; waste disposal; equipment operation; possible archaeological and historic site disturbance
C. Construction of facilities*	Surface change; soil removal and disturbance; change in visual quality; dewatering; blasting; equipment operation; possible archaeological and historic site disturbance; waste disposal; equipment operation
D. Site drainage and grading*	Surface change; vegetation change; soil removal and disturbance; change in visual quality; waste disposal; equipment operation; possible archaeological and historic site disturbance
E. Site restoration*	Surface change; vegetation change; soil treatment; change in visual quality; equipment operation
F. Other activities	
1. Safety fencing*	Change in visual quality
2. Support activities (dust control)	Soil treatment; equipment operation
3. Bypassing sewage	Normally not permitted; if required, special facilities constructed

Source: Wilson (1981).

For most other alternatives, construction of treatment facilities in Twining would have an impact on only the plant site. For alternative 12 (rehabilitation) the effects would be concentrated on the existing acre of already altered land (part of three acres of National Forest land used by TWSD under a permit granted by USFS). For alternatives 1 or 2 the layout of facilities would require an additional acre of National Forest land which would have to be acquired through a modified permit. This acre would be converted from forest land to a building site, through construction of new wastewater facilities. The impacts of construction at the plant would be similar to (but much smaller in scale than) those noted in Table 6-1.

Alternatives involving on-site systems would involve more substantial construction, either outside existing and new dwellings where there would be excavations (alternatives 3, 9), or inside existing dwellings where there would be major remodeling (alternatives 4, 14).

6.1.4 Impacts of Capacity Alternatives

Alternative B (80,000 gpd) would not preclude considerable new construction, primarily of cabins; there would be local and small-scale construction impacts of the type described in Table 6-1. A total of five to ten acres would probably be affected (that is, a few thousand square feet at each of 94 lots). In addition, most of the impacts associated with the TSV, Inc. master plan would occur, such as erosion from remodeled parking lots and from clearing for ski trails and lifts. These impacts are identified in USFS (1981a and 1981b); soil erosion would increase on up to 69 acres of trails, 5.4 acres of lift corridors, 2 miles of access roads, and 5 acres at the parking lots. The effects are projected to be a temporary increase in soil loss from less than 2 tons per acre to perhaps 5 tons per acre; revegetation and other control measures would reduce erosion to background levels within three years.

Alternative E (95,000 gpd) would increase these impacts by supporting additional base-area construction; assuming typical high-density development two to five additional acres might be affected. (The same impacts could occur from alternative B if the developers use on-site systems.) TWSD has indicated an intention to mitigate impacts by requiring proper construction methods and scheduling, including the following measures: a) use excavated soil to construct a temporary dike upslope of any exposed areas, so that the runoff can be diverted around the bare construction site; b) use excavated soil to construct temporary dams downslope from exposed ares, so that the runoff from these areas can be contained and de-silted; c) schedule construction so that earth-moving is not premature, but begins immediately before actual building of the facilities; d) where appropriate, regrade and seed the altered area immediately upon completion of construction.

The principal earth-resource impacts of additional development in TWSD would be short-term land disturbance and a temporary increase in the potential for turbid runoff. No permanent or large-scale changes in land stability, watershed behavior or river ecology would be expected to occur as a result of the construction.

During the public participation process the question was raised regarding possible impacts of TWSD development on climate; this concern related in part to a letter by Joan Price, Director of the Colorado Plateau Project, regarding development in Arizona's Snow Bowl (Price, 1979). The letter cited studies which presented evidence of slight temperature rises due to urbanization in St. Louis, and which discussed a possible impact on electrical and moisture cycles along with lightning and associated ion movement from timber clearing, new parking lots and the like in the Snow Bowl area. The state-of-the-art on climate change is not sufficiently advanced to permit evaluation of this impact. However, as a general statement it is likely that the effects of growth in Twining would be negligible at most (and probably zero) and would be impossible to detect. One ski resort cannot have the effects of urban areas such as St. Louis, nor can it produce possible global changes in climate such as may result from fossil-fuel combustion or volcanic eruptions.

6.1.5 Impacts of Other Types of Alternatives

Most of the remaining components of a complete wastewater system have little or no effect on earth resources. Impacts from on-site systems and sewer construction are identified in Table 6-1. Reuse of sludge within the District could benefit soil fertility, pH and texture; however, runoff of phosphorus-rich sludge could negate water-quality improvements resulting from construction of an advanced treatment facility. Non-point source management programs which use fertilizer to promote vegetation growth benefits the control of erosion but may also add nutrients to runoff; see section 6.2.2. The use of lime to increase soil pH could also affect water quality (particularly by enhancing the solubility of phosphorus and increasing the proportion of unionized ammonia); however, unlike the fertilizer contribution, calculations indicate this effect would be quantitatively insignificant (Wilson, 1981).

6.1.6 Impacts of EPA and Other Agency Alternatives

The principal impacts on earth resources would relate to treatment plant construction - which cannot be avoided if the pollution problem is to be solved - and from area growth - which can occur with or without expansion of plant capacity. Thus, the impacts associated with all of EPA's alternatives are essentially identical, except as to the scale and location of treatment plant construction (which would be much greater for regional alternatives). Also, if EPA were to fund plant expansion, the impacts associated with new development in some sense would be encouraged (or at least accepted).

The treatment plant is on National Forest land and TWSD has a special use permit from the U.S. Forest Service (see Table A-1, Appendix A). If some new land is required, the permit will need an amendment. USFS will require the mitigation of construction impacts from plant construction. Based on the master plan EIS, the agency would require an environmental assessment be completed prior to construction; the assessment would contain specific plans for soil stockpiling, revegetation, runoff control structures and other appropriate measures (USFS, 1981a and 1981b).

6.2 WATER RESOURCES

6.2.1 Existing Surface Water Quantity

The headwaters of the Rio Hondo have an average elevation of approximately 11,400 feet; thus, annual snowfall and spring runoff are large. Appendix C.1 summarizes streamflow data obtained at U.S. Geological Survey gauging stations in the watershed. For the period of record the annual runoff from the mountain portion of the basin (above Valdez) has averaged 25,650 acre-feet or 13.3 inches. Figure 6-2 illustrates the seasonal flow pattern in which more than half the annual stream flow occurs in response to snowmelt from April through July.

There has been a significant (25 to 40 percent) decrease in the flow measured at the Valdez gauging station in the last 20 to 30 years (Wilson, 1978; USFS, 1981a and 1981b). Virtually the entire reduction has occurred during the spring snowmelt period. Analyses of available data have identified several potential causes of the change. Appendix C.2 summarizes the studies which have been done, and indicates that revegetation of National Forest lands is responsible for the bulk of the change. Long-term drought conditions have also contributed to the decrease. The reduction in flows has had a significant adverse impact on downstream farmers. In particular, there is now often too little water in spring to fully irrigate the soil; in the past such heavy spring irrigation could mitigate the inevitable shortage of water in late summer. These problems are not unique to the Hondo drainage, but occur throughout northern Taos County.

There is considerable public interest concerning the impact of development in TWSD on the physical supply of water in the drainage basin. The evidence indicates that this impact is insignificant and, if anything, on balance a positive one. The consumptive use of water within the District has been offset by retirement of downstream irrigation rights; also, the consumption occurs primarily in winter, when there is minimal downstream irrigation. While water rights transfers do protect stream flow, they have potential socio-economic effects; see section 6.6.6.

Snowmaking by Taos Ski Valley, Inc. may actually improve water supply, since water that normally would flow downstream in winter instead becomes part of the spring runoff which is available to irrigators. The clearcutting of trails also increases runoff because open areas accumulate more snow than

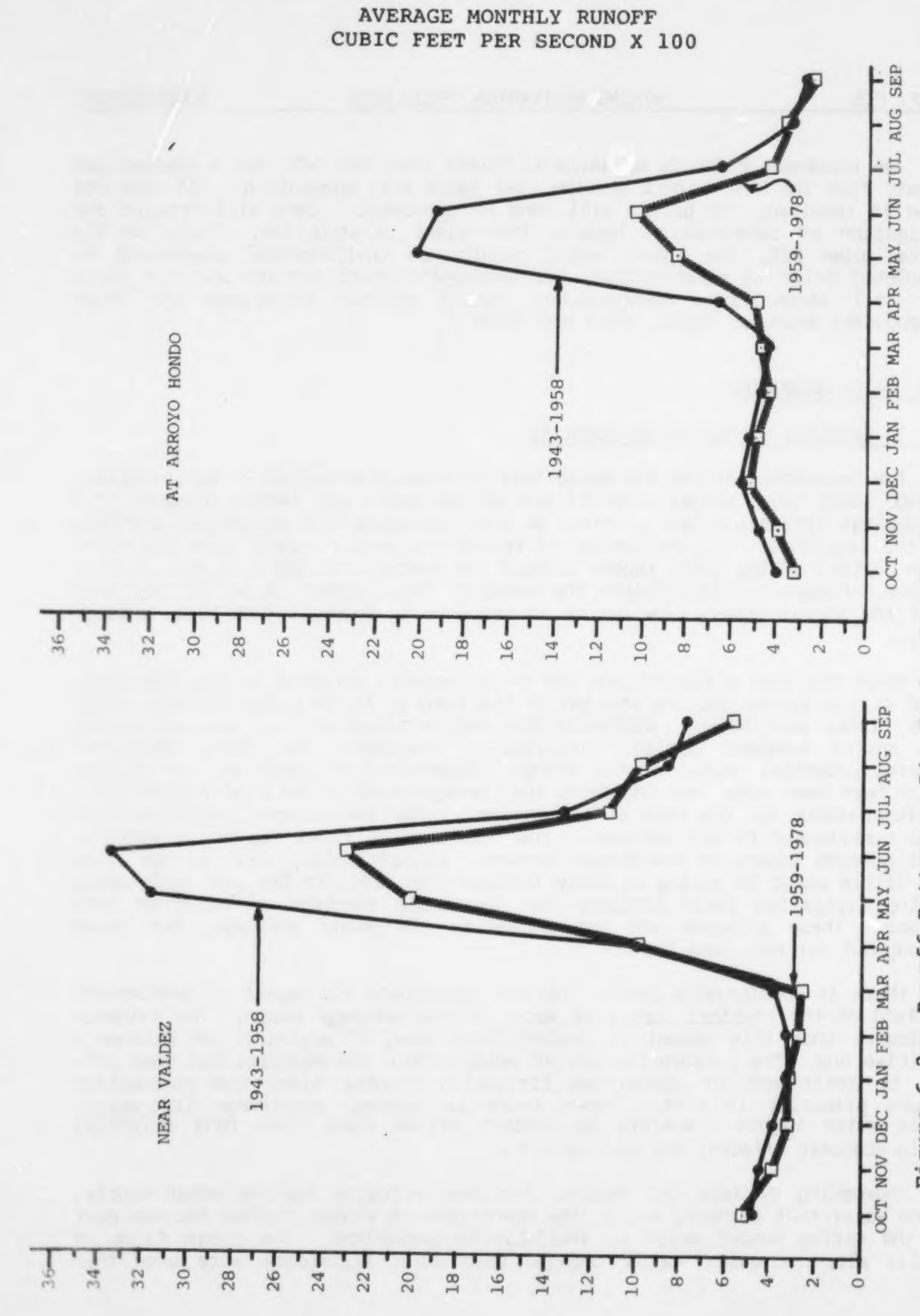


Figure 6-2. Runoff Patterns, Rio Hondo, New Mexico

areas with tree cover and because there is a reduced transpiration requirement, due to the tree removal. Trail grooming compacts the snow and delays runoff slightly. USFS (1981a and 1981b) indicates that the positive benefits of ski trails are too small to be measured at the Valdez gauging station.

The 100-year flood hazard zone for Twining has been identified by the Corps of Engineers (Cunico, 1980) on a map on file at the Forest Service Supervisor's office on Cruz Alto Road, Taos. The map indicates that neither the existing treatment plant nor any occupied dwelling is in a flood hazard zone. The extent of development compared to the size of the basin makes it extremely unlikely that the resort has had any effect on downstream flood hazards. A detailed evaluation of low-flows was performed by EID as part of the wasteload allocations; the results are summarized in Appendix B.4.

6.2.2. Existing Surface Water Quality

Stream Standards. Stream standards are set by the New Mexico Water Quality Control Commission, (and must be approved by the State Attorney General and by EPA). The purpose of the standards is to protect the stream for particular designated uses. Some standards are general for New Mexico and are qualitative (e.g., the stream shall be free of objectionable oil, scum and grease). Other standards are set for particular stream reaches and are numeric for specific parameters (e.g., pH shall be within the range 6.6 to 8.8).

Designated uses for the Rio Hondo (and almost all other perennial streams in Taos County) are: domestic water supply (but disinfection is required prior to drinking); fish culture; high-quality coldwater fishery (trout); irrigation; livestock and wildlife watering; and secondary contact recreation (boating, but not swimming). The numeric standards are listed in Table 4-1; Table C-2 also lists the standards, along with the stream uses each is designed to protect and the rationale behind each specific value.

The stream standards were recently revised by the New Mexico Water Quality Control Commission (1981); however, the standards have not been certified yet by the New Mexico Attorney General, nor has EPA approval been given. The changes are:

Old Standards	New Standards
Ammonia nitrogen was limited to 0.2 mg/l. At pH's of the Rio Hondo, this standard should keep un-ionized ammonia (the toxic form) to less than 0.02 mg/l.	Un-ionized ammonia not to exceed 0.02 mg/l (as N).

Nitrate-nitrogen limited to 0.8 mg/l. Combined with total ammonia standard, this would keep total inorganic nitrogen less than 1.0 mg/l.	No nitrate standard. Total inorganic nitrogen not to exceed 1.0 mg/l.

The fact that a stream is better in quality than permitted by the standards does not justify allowing the quality to deteriorate. The official State policy on such degradation is as follows.

> "Degradation of waters the quality of which is better than the stream standards established by the New Mexico Water Quality Control Commission is not reasonable degradation and is subject to abatement under the authority granted the Commission by the New Mexico Water Quality Act, as amended, unless it is justifiable as a result of necessary economic and social development. Existing instream water uses shall be maintained and protected."

Wasteload Allocations. Under the New Mexico Water Quality Management Plan, certain streams are designated as "water-quality limited". The Rio Hondo has received this designation. When a water-quality limited stream is being considered for point-source discharge, the New Mexico Water Quality Control Commission, via EID, does a "wasteload allocation". For a particular pollutant, it is determined how much of that pollutant may load (be discharged to) the stream (at low-flow conditions) before the stream standard is violated. The effluent limit assigned to the point source discharge is then set so that the allowable wasteload is not exceeded. For example, the phosphorus standard for the Rio Hondo is 0.1 mg/l. For low-flow conditions at Twining, this translates to about 2 pounds of phosphorus per day. Stream sampling indicates that as much as 1.1 pounds may be contributed by non-point sources; thus, 0.9 pounds are "left" for the treatment plant discharge. This means that a 95,000 gpd plant must have an effluent containing no more than 1 mg/l of phosphorus. (Appendix B.4 presents this calculation in more detail; see also EID, 1981d.)

Wasteload allocations are not necessary for all parameters for which there are stream standards. For example, a violation of the Rio Hondo dissolved oxygen standard has never been observed, even when the treatment plant has been out of compliance. Therefore, it is not considered necessary to do a dissolved oxygen allocation. Also, as discussed in the next sub-section, EID has determined that no allocation is needed for nitrogen.

"Secondary treatment" is defined as treatment which removes nearly all floating solids from wastewater and which reduces each of BOD (biochemical oxygen demand) and TSS (total settleable solids) to less than 30 mg/l. Because the wasteload allocation has determined that Twining must remove phosphorus, the treatment required is more stringent than secondary, but not to "advanced waste treatment" levels (BOD and TSS less than 10 mg/l each and/or 50 percent removal of total nitrogen). Therefore, the treatment level required in this case is referred to as advanced secondary treatment (AST), in accordance with PRM 79-7, as revised June 20, 1980 (EPA, 1979e). Under PRM 79-7, any facility plan involving a treatment works providing treatment more stringent than secondary requires additional review by EPA to ensure treatment is necessary and will have water quality benefits.

Limiting Nutrient Concept. The purpose of the phosphorus and nitrogen standards is to prevent excessive algal growth. Some algal growth is beneficial to a river, since these plants are part of the food chain and contribute to fish production. But an overabundance of algae can cause odors and unsightly algal mats (slime) and, in the extreme, deplete dissolved oxygen and result in fish kills. Algae require a number of nutrients for growth, including nitrogen and phosphorus. Generally, nitrogen and phosphorus are in low supply relative to other nutrients such as carbon. Therefore, either nitrogen or phosphorus usually will be the "limiting nutrient" to algal growth. If phosphorus is in short supply there will be little algal growth, no matter how much nitrogen is available, and vice versa. In most water bodies phosphorus is the limiting nutrient. Municipal wastewater normally contains a lot of phosphorus; thus it is common for rivers to be algal-rich downstream of discharge points. In such cases the key to pollution control is wastewater treatment to remove phosphorus; such treatment is comparatively easy to accomplish. Where a river is phosphorus-limited the nitrogen loading is irrelevant (with regard to algal growth) as long as phosphorus loading is minimized. This is fortunate since treatment to reduce nitrogen is difficult and much more costly than phosphorus removal. For these reasons, the new state stream standards state that:

> "As the need arises, the State shall determine, for specified stream segments or relevant portions thereof, whether the limiting nutrient for the growth of aquatic plants is nitrogen or phosphorus. Upon such a determination, the waters in question shall be exempt from the standard for the nutrient found to be not limiting."

The method for determining whether a stream is nitrogen or phosphorus-limited consists of a test termed "algal assay". To date, EID has performed 19 such algal assays for the Rio Hondo (Tague, 1981). Most of the tests were done on water samples taken at HON3 (above the treatment plant), and all definitely confirm that phosphorus is the limiting nutrient. A series of assays was also conducted at other stations above Valdez. These showed that, under present conditions of excessive phosphorus loading, the stream is temporarily nitrogen-limited just below the treatment plant. At all other stations the stream was phosphorus-limited. Thus, under the new stream standards, the Rio Hondo is exempt from the total inorganic nitrogen standard.

Based on these assays it is clear that to reduce algal growth in the Rio Hondo and improve water quality it is necessary for TWSD to reduce the amount of phosphorus discharged to the river. The control of nitrogen would provide no additional benefits yet would raise costs substantially (about one-third; see Table B-2); it is cost-effective to require only phosphorus treatment and no nitrogen removal. Thus the wasteload allocations on which plant design are based involve phosphorus (see Appendix B.4, section 5.3.2, and EID, 1981d).

Another cost-saving aspect of the wasteload allocation for Twining is the seasonal permit (see Table 4-1). The 1 mg/l effluent limitation for phosphorus is based on winter conditions, when the stream flow is low and sewage flow is high. However, in the summer stream flow is high and sewage flow low; therefore, the effluent phosphorus concentration can be higher without overloading the stream (i.e. the dilution factor is greater). With this in consideration, the permit requires less phosphorus treatment in the summer, which means that less money would be spent on operation and maintenance for phosphorus removal. (The seasonal permit assumes that Twining will not become a summer resort area.)

Water-Quality Data. Table 6-2 summarizes all available data regarding water quality in the Rio Hondo watershed. Figure 6-3 illustrates the results of the most detailed surveys described in the Table. The figure shows that violations of stream standards occur most frequently at HON8, about 300 yards downstream from the treatment plant. More than a third of the HON8 samples in the '74-'75 survey and one-quarter to one-third of more recent samples showed violations of bacteria, phosphorus and ammonia standards. Violations of these standards are also seen at HON10, 1.5 miles below the plant, but at HON12, 6 miles below the plant, no violations have been observed. Some violations of bacteria and nutrient standards have occurred in the lower reaches of the Rio Hondo, presumably due to contributions from agriculture, livestock and on-site systems. At all stations, values for temperature, pH, conductivity and dissolved oxygen have all been in compliance.

The results of the EID surveys are also illustrated by Figure 6-4, which shows graphically how different parameters vary in a downstream direction. HON6, which is the treatment plant outfall, is included on the graphs for comparison, but stream standards do not apply to that station. Generally, nutrients and bacteria increase immediately below the treatment plant, then return to background levels by station HON12, and finally increase somewhat as the stream passes through the more populated and cultivated lower valley.

Figure 6-4a compares average values for summer (May through October) and winter (November through April) and shows that the influence of the treatment plant is greatest in the winter; nearly all violations of stream standards occur during the winter months. In contrast, in the lower Rio Hondo higher fecal coliform counts occur in the summer. Figure 6-4b compares average values for the '74-'75 survey against those for more recent sampling. Generally, water quality at HON8 has been better during the more recent sampling. This improvement may be attributed to: 1) higher stream flows providing more dilution of the effluent; 2) smaller effluent flows; and 3) improved sewage treatment. Collectively, the data indicate that at the mouth of Hondo Canyon, except for a small elevation in phosphorus levels, there is no evidence of the effluent discharged by TWSD.

TABLE 6-2. SUMMARY OF WATER QUALITY DATA, RIO HONDO

This table lists data sets which have been gathered regarding the quality of surface or ground water in the watershed, and identifies major conclusions which can be reached from the data. See also Figures 6-3 and 6-4. Actual data are available from sources cited or can be obtained from Lee Wilson and Associates, Inc., P.O. Box 931, Santa Fe NM 87501. Most data are contained in reports on file at depositories listed in Chapter 7.

A. 1974/1975 Survey

EIA (1975) summarizes an extensive survey of Rio Hondo water quality which was conducted in 1974 and 1975; Appendix C.3 describes the sampling stations. Major conclusions of the study are illustrated in Figures 6-3 and 6-4 and can be summarized as follows.

1. At most stations the stream standards are not violated.

2. The most notable exceptions occur at station HON-8, which is 300 yards below the outfall of the Twining treatment plant. There, violations of stream standards occurred about one-third of the time for fecal coliform, chlorine residual, ammonia and phosphorus. Also, one sample was in violation of the total organic carbon standard.

3. A few violations of ammonia and phosphorus standards occurred at station HON-10, 2.4 miles below the treatment plant. Three fecal coliform violations were found at station HON-10, and one violation each at HON-14 and HON-16.

4. HON-2 and HON-4, both above the treatment plant, experienced violations for ammonia, phosphorus, and total organic carbon.

5. Average values for temperature, conductivity and pH increase downstream, which is normal.

6. Nutrients, turbidity and fecal coliform all increase significantly at station HON-8, which is only 300 yards below the treatment plant outfall; however, by station HON-10 or HON-12, the average values are back to levels comparable to those found above the treatment plant.

7. Possible impacts from agricultural activity in the lower valley are indicated by relatively high values for total Kjeldahl nitrogen (ammonia and organic nitrogen) at station HON-16, and elevated fecal coliform levels from station HON-14 on down. This could reflect higher human and cattle populations along that stretch.

8. Figure 6-4a compares Rio Hondo water quality in the summer and in the winter. Stream quality in the mountain reach is much poorer in winter than summer, as would be expected because of greater sewage plant discharges and lower stream flows. Station HON-2, above the treatment plant, also shows higher levels of constituents in the winter months. This station is at a point in the midst of the ski valley, and so probably receives the impact of increased winter populations (automotive exhaust, litter, etc.).

9. All stations showed some high nitrate values; however, nearly all these high values were from samples taken on the same two dates and are labeled "suspect". One low dissolved oxygen concentration is reported at station HON-20; it is also labeled "suspect". These values were not utilized in calculating the averages shown in Figure 6-4.

10. Dissolved oxygen, nitrate, pH and COD levels remain relatively constant along the length of the Rio Hondo.

B. More recent EID Data

EID took a few samples in winter of 1978 and spring of 1979, and since November of 1979 they have taken samples on nearly a monthly basis. A few changes were made in the sampling program (compared to the '74-'75 survey). Because it was felt that HON1 and HON2 were too affected by ski basin activities, those stations were dropped; a new station, HON3, was established on the North Fork, with the belief that this station more truly reflects background levels. Stations HON14 and HON16 were dropped, and no analyses were done for turbidity, chlorine residual, total organic carbon, phosphate, or chemical oxygen demand.

Figure 6-4b compares '74-'75 average values and more recent values for fecal coliforms, dissolved oxygen, phosphorus, and ammonia. Generally the same pattern is seen in both periods, with values spiking up at HON8, just below the treatment plant, and then returning to near-background levels. However, the more recent data show the river (and the effluent) to be of better quality than in 1974-1975. The percentages of samples showing violations of stream standards has decreased somewhat (Fig. 6-3).

C. USGS Data.

Three samples from the stream at State Highway 3 (HON18) were taken by the USGS in 1956 and 1957; analyses were done for several inorganic parameters. Samples taken from near Valdez by USGS from 1962 to 1965 provide some conductivity and suspended sediment data.

D. USFS Data.

The Forest Service took samples in '67, '68 and '69 from the same site (HON18) and analyzed for several inorganic constituents. When these data and USGS data are compared to more recent records there is no apparent change in stream chemistry.

USFS took samples from the upper Rio Hondo (HON2 to HON12) on eleven winter dates from January 1978 to January 1979. These samples were analyzed for turbidity and fecal coliforms; on one date, counts were also done for fecal streptococci. Few bacteria were detected above the treatment plant, relatively high numbers were seen at HON8 and HON10, and numbers were again small at HON12. There was one violation of stream standards for fecal coliforms at HON8, and three violations at HON10.

TABLE 6-2. SUMMARY OF WATER QUALITY DATA, RIO HONDO (continued).

E. BLM Data.

In October of 1978, the Bureau of Land Management started a monthly sampling program on the Rio Hondo just above its confluence with the Rio Grande (HON20). The data are stored by USGS as station 08268500 (Arroyo Hondo at Arroyo Hondo). Analyses have been done for a large number of parameters, including major cations and anions, metals, nutrients, and dissolved gases. One or two violations of stream standards have been observed for turbidity, pH, ammonia, nitrate, phosphorus, total organic carbon, and fecal coliforms. Several zinc values have been over 0.05 mg/l, the recommended limit for drinking water.

F. TWSD.

In the early fall of 1979, Cramer, Callahan and Associates collected samples at stations HON4, HON8, HON12, HON14, HON18 and HON20 for the TWSD. The samples were analyzed for BOD, total phosphorus, pH, fecal and total coliforms, and suspended solids. Values were highest at HON8 for all parameters except pH and suspended solids. The stream standard for phosphorus was violated at these stations.

G. Metals Data.

On April 8, 1980, EID analyzed samples for arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver. All values were below detectable limits, except two cadmium and one lead, which were right at detectable limits (0.001 mg/l and 0.005 mg/l respectively, which are below recommended criteria).

Since September, 1980, samples have been collected on four dates by the Forest Service and analyzed by MolyCorp for iron, manganese, zinc, molybdenum, copper, lead and cadmium. Most values have been below detectable limits. The most notable exception is zinc. Except for the September 2 sampling date, nearly every zinc value at every station has been above EPA criteria for protection of aquatic life (0.01 mg/l), and many have been above the criteria for drinking water (0.05 mg/l). Two or three excessive values have been observed for each of iron, manganese, and lead. Natural weathering of minerals (e.g. in ore deposits) is the probable origin of these metals; the reported levels are not unusual in U.S. rivers. High zinc concentrations could be a factor limiting the reproduction of cutthroat trout in the stream (Wilson, 1981).

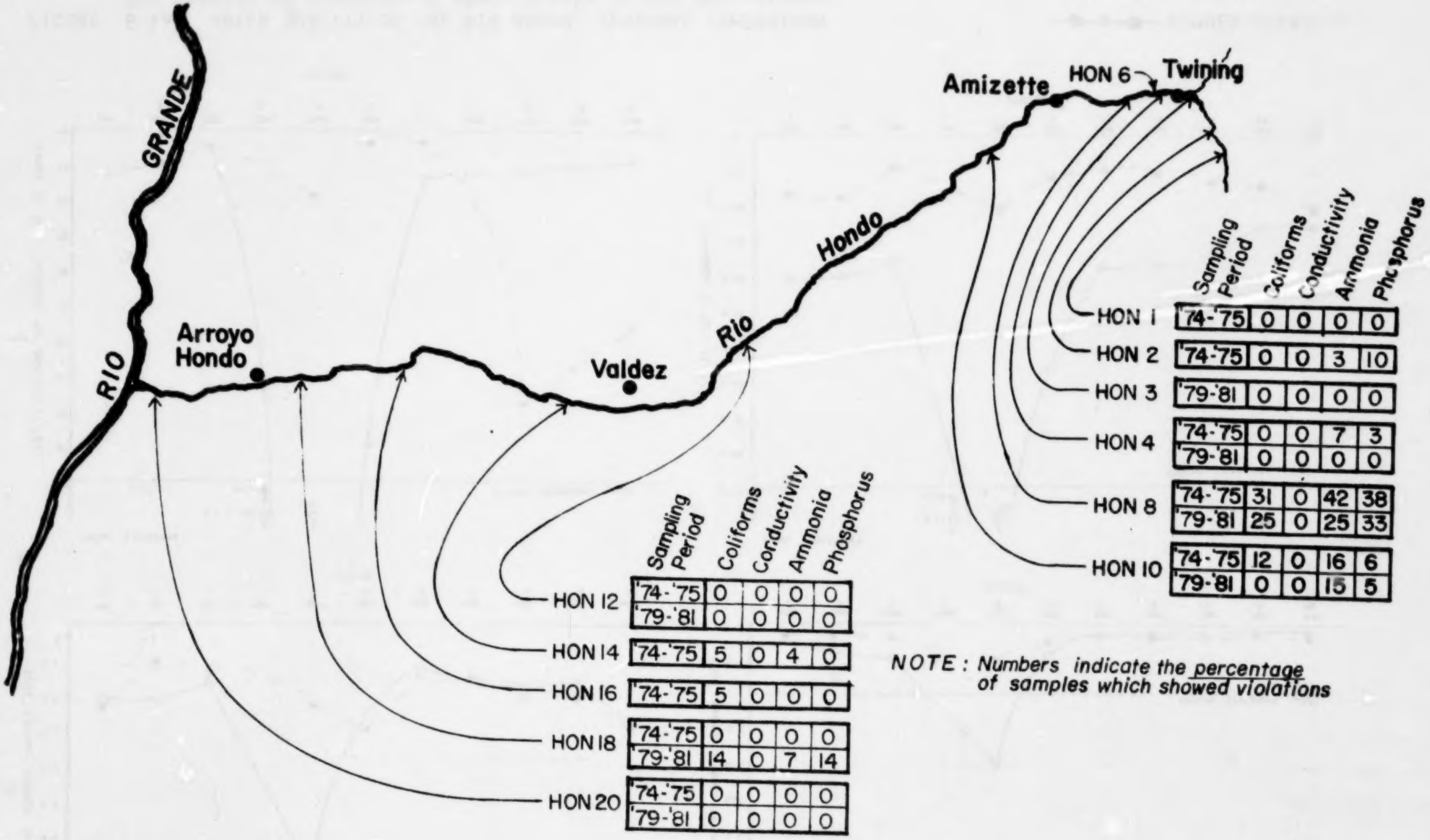
H. Drinking Water.

Records are on file at EID for the community water systems in Twining, Des Montes, Valdez, and Arroyo Hondo. Except for Twining, these systems pump their water from wells, so that the data reflects ground water quality, which is generally very good.

Lee Wilson and Associates collected eight samples from private wells in Valdez and Arroyo Hondo for the Taos County Future Water Issues report. Six of these samples were positive for total and fecal coliforms, possibly due to contamination from onsite systems.

I. Other.

There are no data on several types of contaminants. These include viruses and parasites, both of which are probably present to a limited extent, as indicated by the slightly elevated levels of bacteria. Surfactants, reflecting detergent discharges, have never been measured; EID has noted no evidence that this type of pollution is significant in the basin (Tague, 1981). Trace chemicals - such as trihalomethanes - have not been measured and would not be expected to occur unless from natural sources; while trihalomethanes are produced by chlorination of fresh water, they are not an important product of wastewater chlorination (Wilson, 1981).



	Sampling Period	Coliforms	Conductivity	Ammonia	Phosphorus
HON 1	'74-'75	0	0	0	0
HON 2	'74-'75	0	0	3	10
HON 3	'79-'81	0	0	0	0
HON 4	'74-'75	0	0	7	3
	'79-'81	0	0	0	0
HON 8	'74-'75	31	0	42	38
	'79-'81	25	0	25	33
HON 10	'74-'75	12	0	16	6
	'79-'81	0	0	15	5

	Sampling Period	Coliforms	Conductivity	Ammonia	Phosphorus
HON 12	'74-'75	0	0	0	0
	'79-'81	0	0	0	0
HON 14	'74-'75	5	0	4	0
HON 16	'74-'75	5	0	0	0
HON 18	'74-'75	0	0	0	0
	'79-'81	14	0	7	14
HON 20	'74-'75	0	0	0	0
	'79-'81	0	0	0	0

NOTE: Numbers indicate the percentage of samples which showed violations

FIGURE 6-3
VIOLATIONS OF STREAM STANDARDS, RIO HONDO

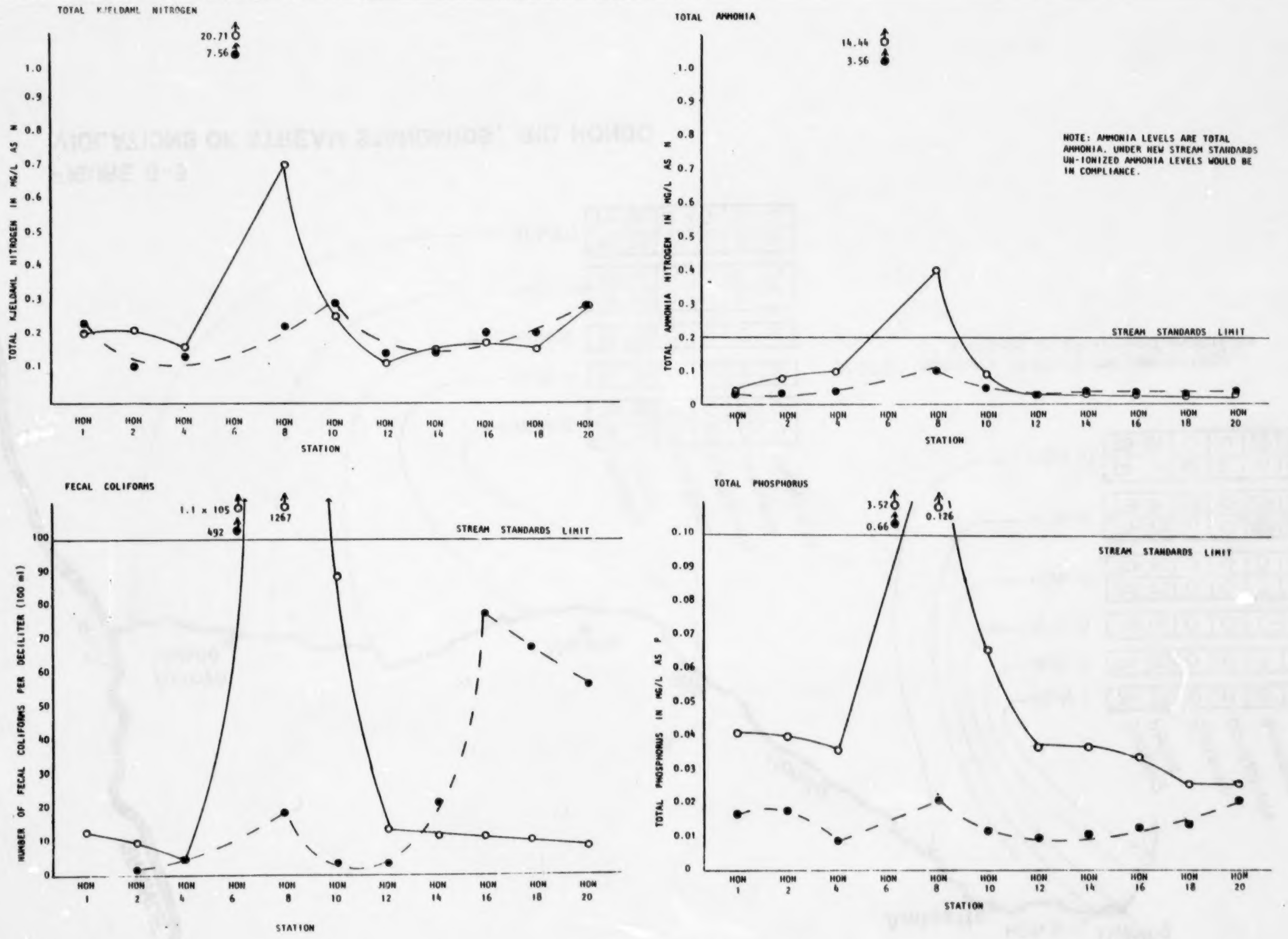


FIGURE 6-4a. WATER QUALITY OF THE RIO HONDO; SEASONAL COMPARISON
The spacing of stations on these graphs is not proportional to their actual distances(see figure 6-3).

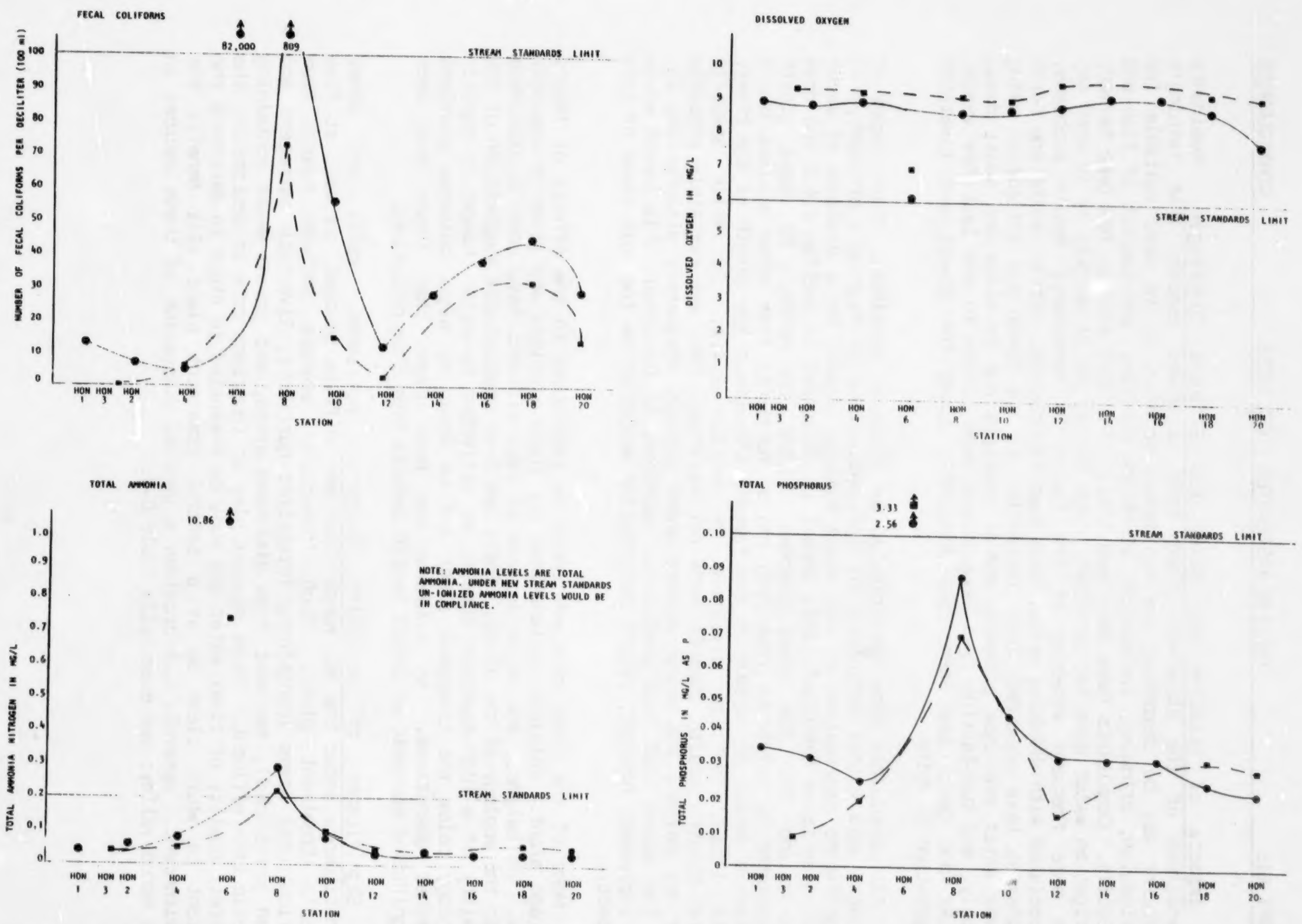


FIGURE 6-4b. WATER QUALITY OF THE RIO HONDO; COMPARISON OVER TIME
The spacing of stations on these graphs is not proportional to their actual distances (see figure 6-3).
HON 6 is treatment plant effluent: The data for it summarized here is EID surveillance data, not compliance data

-●-●-●- 1974-'75 data

-■-■-■- 1979-'81 data

Impacts of Existing and Past TWSD Effluent Discharges. Residents downstream of the treatment plant have expressed concern that Twining's effluent may be degrading the Rio Hondo so that it is less suitable for irrigation, drinking, recreation, livestock watering, and support of fish and wildlife. Complaints have been made that: the river ecology has been harmed; irrigation water does not penetrate into the ground as quickly as it used to, and more frequent watering of the fields is necessary; health problems, associated with drinking water, have been experienced; cattle deaths and horse illnesses have occurred; both recreation in the river and irrigation using river water are less pleasant and/or feasible due to slime and suds; dead, sickly, and bad-tasting fish have become more common in the last few years; ducks and geese are seen less frequently along the river; and riverside vegetation is dying.

All complaints were investigated as fully as possible. Three types of impacts were either definitely or presumably tied to Twining's effluent. 1) Significant degradation of Rio Hondo biology occurs for a distance of about two miles below the plant; this impact is discussed in section 6.4.1 and does not extend into the lower reaches of the Rio Hondo. 2) Algal growth stimulated by nutrients from TWSD and by nutrients from other sources has a nuisance impact on recreation and farming throughout the length of the river; this impact is also discussed in section 6.4.1. 3) While specific water-related health impacts were not verified, they are certainly possible for any persons who drink surface water without adequately disinfecting it. To the extent that TWSD contributes pathogens to the river, this impact would be increased; however, TWSD's contribution would not be the sole cause of this impact.

None of the other problems could be attributed to the effects of TWSD's sewage plant. Possible explanations for these problems are given in Appendix C.4. On balance, the major impacts of TWSD effluent have been to interfere with the ecology of the river. There has been unacceptable degradation of the quality of a high-mountain stream, as reflected by major changes in aquatic biology below the treatment plant and as shown by algal nuisance problems further downstream. No evidence has been found that there have been significant economic or public health impacts from this pollution.

Significance of Non-Point Sources. Nutrients, salts and other constituents enter the Rio Hondo from many diffuse sources, as well as from TWSD's treatment plant. Such 'non-point' sources include runoff from agricultural areas (containing fertilizer nutrients, livestock pathogens and even pesticides), sediment from disturbed areas, and ground water containing septic tank effluent. These sources play an important role in determining the overall quality of river water and must be evaluated in order to determine the extent to which clean up at a central treatment plant will benefit the environment. Appendix C.5 provides a general discussion of these sources in the Hondo Valley; see especially Table C-4.

The impact of non-point sources on phosphorus levels in the upper Rio Hondo (within TWSD) was explicitly considered in the wasteload allocation process described in this section, in section 5.3.2, and in Appendix B.4. Non-point sources of phosphorus within the District are summarized in Appendix C.6; see especially Table C-5. The background level of phosphorus is about 0.005 mg/l. As the river flows through the base area, phosphorus increases to 0.02-0.03 mg/l; thus, non-point sources have at least a four to six-fold impact. The principal sources of this pollution (which is 20 to 30 percent of that allowed by the stream standards) include: runoff from natural forest land; runoff containing fertilizers used on ski trails; runoff from parking lots and developed land in the base area; and effluent from septic tanks. The effect of the latter has been noted during EID field surveys, which have found algal growths in the Rio Hondo at approximately the point where the effluent from the Kandahar septic tank and dry well enter the stream. Collectively, the existing non-point sources of phosphorus and other pollutants are responsible for significant degradation of the river as it passes through the resort complex; this is reflected by a deterioration in stream ecology (see section 6.4.1).

Similar impacts occur in the lower Hondo where livestock wastes and on-site systems are probably a significant source of contamination. The data in Figures 6-3 and 6-4 suggest that these sources already approach a magnitude capable of threatening or exceeding the stream standards for some parameters. The specific question of downstream phosphorus problems is discussed in section 6.2.6.

6.2.3 Ground Water Quantity and Quality

Wilson (1981) discusses ground-water conditions throughout Taos County. Ground water occurs in two types of aquifers in the Twining area: in the fractures of the bedrock; and in the pores of the valley alluvium. In the bedrock, aquifer flows may be significant where the rock is extensively fractured, but quite commonly the rock is tight and yields little flow. In the alluvium, the varied nature of the material provides a moderately effective medium for water storage, and small to moderate-yield wells can be developed in many parts of the area. For both aquifers rates of recharge are high because of the infiltration of snowmelt. The high recharge rates are reflected by a high water table, which in turn accounts for the problem of sewer line infiltration; building construction is also hampered because of wet conditions on most sites.

The natural flow path is toward the Rio Hondo; any ground water not intercepted by wells eventually reaches the river and becomes part of the stream flow. The close relationship between surface and ground water has been demonstrated by analyses made for this EIS (Jenkins, 1981). Standard techniques were used to calculate the effects of discharges to or pumping from the aquifer. The analysis indicates that the ground-water flow in the area averages between 10 and 15 feet per day, which is quite rapid due to the steep water-table gradient. Any wastewater (such as septic tank effluent) which reaches the water table would flow rapidly to the river, reaching it between 1 week and 3 months of discharge (depending on whether the discharge was 100 or 1000 feet from river). Similarly, pumping of the aquifer results in very rapid transmission of the effects to the river, effectively diminishing stream flow by 90 percent of the amount pumped within a few weeks. The remaining 10 percent would be reflected by diminished stream flow over a period of up to 1 year after the pumping.

In effect, the aquifers serve as a rapid 'flow-through' system by which some snowmelt and rainfall reaches the river. The impact of septic tank discharges or well pumping is rapidly transmitted to the river; the effects of discharge or pumping on the aquifers are relatively small and localized. The water table in the mountain area has not declined as a result of development; this is shown by the fact that there has been no decrease in stream flow in late summer and fall (see Figure 6-2), a time in which most or all of the river water originates as ground-water discharges.

In the lower Hondo Valley the aquifer system is different, generally being much better in terms of water yields, but lacking the high rates of recharge. The effects of discharges to or pumping from the aquifer are directly felt at the river, but over periods of several months or years (depending on distance). Thus, while the water table may drop slightly as well pumping increases, the main effect of ground-water diversions is to reduce stream flow. The historic decline of runoff may have caused the water table in the area to decline slightly. However, a major regional decline in the water table would never occur so long as river flows remain significant.

Ground-water quality. The limited data on ground-water quality (mostly for community water systems) indicates that the resource is in good condition. However, Wilson (1980) reports bacterial contamination of several private wells in Valdez and Arroyo Hondo; these are presumed to be caused by site-specific contamination from livestock wastes or on-site systems.

6.2.4 Water Supply and Water Rights

Runoff in the Rio Hondo is the source of the TWSD water supply and is used extensively in the lower valley for irrigation purposes. The stream is also a high-quality fishery. Within the upper Hondo Canyon some domestic wells tap the alluvial aquifer to provide a domestic water supply. In the lower valley, ground water is the source of virtually all domestic water, through individual wells and community water systems.

Twining Water System. Most of the resort complex obtains water from the community system owned and operated by TWSD and the Pattison Trust. Those few residents who are not hooked up to the system are served by domestic wells. Appendix C.4 contains information on the community system, which takes surface water from the Rio Hondo. The system has one unusual feature - large diversions are made for the purpose of keeping pipes full of flowing water during winter, thus avoiding freezing. This so-called bypass flow is apparently discharged back to the river directly or indirectly, without any human use.

Water Use. There are three major categories of water use at TWSD: domestic (for the commercial facilities and cabins); by-passes; and snowmaking. Complete records on the amounts of use are not available, although in the last two years the New Mexico Water Resources Division (WRD, also known as the State Engineer) has investigated this matter, required improvements in metering, and made an estimate that in 1980 the total water diverted was 141.1 acre-feet (Cooper, 1981). Independent estimates of water use in the District were developed as part of the facilities planning process, based upon information supplied by Twining residents and measurements of sewage flow. The methods used for this work are described in Appendix C.8. The results can be expressed in terms of the per capita water use and sewage flow, as follows:

	Diversion	Consumptive Use	Return Flow
Day skiers and employees	14	4	10
Overnight residents and employees	71	21	50

When these numbers are used in conjunction with population data, the annual use is estimated to be 31.1 acre-feet/year (AFY) for diversions, of which 21.8 AFY is returned as discharges from the sewage plant and on-site systems and 9.3 AFY is consumed (see Appendix C.8).

Bypass flows may be as large as 532 AFY, mostly for the cabins (see Appendix C.8). However, based on the WRD study, in 1980 the bypass could not have been much greater than 105 AFY. Further study by WRD is expected to resolve this apparent conflict. Water use for snowmaking can be estimated based on the operational characteristics of the equipment used. In a typical year, about 5 AF would be diverted (SEO, 1980); 10 to 30 percent of this, or 0.5 to 1.5 AFY, would be consumed (see Appendix C.8).

All together, the water use is estimated as follows (all values in AFY):

	Domestic	By-Pass	Snowmaking	Total Water Use
Diversions	31.1	105 - 500	5	141.1 - 536.1
Return Flow	21.8	105 - 500	3.5	130.3 - 525.3
Consumption	9.3	0	1.5	10.8

Water Quality. The TWSD water supply is of good quality, reflecting the basic good quality of the Rio Hondo. However, as with all water supplies, complete disinfection is sometimes a problem. On four occasions in 1978 and

1979, bacterial non-compliance (levels more than 5 per 100 milliliters) was evidenced in the monthly water samples. EID has noted possible increased problems associated with the on-site system which serves the Schwendi facilities, upstream from the public water supply. A separate problem was experienced in September, 1980, when runoff from a nearby disturbed area (active trail construction work) carried sediment into the system, causing excessive turbidity levels.

Water Rights. Water rights for the Twining water system are leased from their owner, the Pattison Trust; prior to purchase by the Trust the rights were used for irrigation in the lower valley. These water rights are considered secure, assuming continued renewals of the Pattison Trust lease. In 1976, the District Court issued a partial final decree in the adjudication of water rights on the Rio Hondo. The Court Order allows the Pattison Trust to divert 218.2 acre-feet per year (AFY) from the Rio Hondo and to consume 10.91 AFY. This decision is somewhat unusual because domestic use of water normally consumes at least 25 percent of diversions, and return flow (sewage discharges) is less than 75 percent of diversions. However, the Court Order acknowledges a different ratio: because most of the water used in the District is by-pass flows, which return directly to the river, it is assumed that only 5 percent of water diverted is actually consumed. The Pattison rights are junior in priority to rights such as those in Arroyo Hondo. According to New Mexico law, during a water-short year, those with senior rights should obtain a full water supply and those with junior rights should bear the shortage. However, the only mechanism for enforcing this rule is for the state to appoint a water-master; this has not been done in the Hondo watershed.

Based on the WRD study, 1980 diversions and consumption for domestic and by-pass use are within the limits of the permit. The studies made for the EIS concur with the possible exception that by-pass diversions may exceed the limits. At present there is no formal permit for snowmaking operations, and diversions for this purpose have been stopped by order of the State Engineer dated February 11, 1981 (see Appendix C.8).

Taos Ski Valley, Inc. (TSV, Inc.) owns two parcels of land with irrigation water rights on the Rebulse ditch which diverts from the Rio Hondo. These parcels, which for now remain in cultivation, are 10.9 acres and 4.25 acres, and collectively have consumptive use rights of 18.94 acre feet per year. If TSV, Inc. can demonstrate to WRD that its use is allowed by the existing Pattison permit, then consumptive use authorized under that permit would amount to 10.8 AFY, just below the allowable limit. Otherwise, TSV, Inc. can be expected to apply for a separate permit to divert Rio Hondo water for snowmaking; this will require transfer of at least some of the irrigation rights (and retirement of the existing use to exactly balance the new use). The transfer is subject to administrative procedures of the State Engineer; owners of other water rights in the watershed have legal standing to protest the permit. The impacts of this retirement are discussed in section 6.2.7.

TWSD has been allocated 15 AFY of San Juan-Chama Project water. The rules for use of this water are complex, but basically they could be used by Twining only in the winter, and only if TWSD can demonstrate that river flows in this period are in excess of the needs of irrigators in the lower Hondo Valley. The rights probably could be used for snowmaking, so long as all diversions were outside the irrigation season which would have an impact on the river throughout the spring and summer snowmelt period.) The alternative of physically pumping the water from the Rio Grande to the Ski Valley would be extremely expensive and is not considered practical.

If project water cannot be used in Twining, it is certain that there will be a need to obtain and retire irrigation rights in order to accommodate expected growth and increased water use (see section 6.2.7). TWSD would have to obtain such rights in the marketplace; the District lacks municipal powers to condemn water rights. Small amounts of water rights held by the Forest Service for grazing purposes would not be available to the District (LaSalle, 1981).

Proposed Upgrading. TWSD is proposing to upgrade the water system by regular maintenance of the main water meter, complete metering of all individual users, replacing the Beaver Pond infiltration gallery, placing the existing 50,000 gallon storage tank into service, adding a 200,000 gallon fire protection tank, repairing or replacing some connecting pipes and burial of bypass lines to at least a 5 feet depth (BLL, 1980). The development of a ground water source is being considered, either at a location just below the Schwendi restaurant or along the river above Beaver Pond. Further development of Schwendi infiltration gallery has been proposed, since it has proven to be the most reliable surface water source.

Downstream Use. In the Rio Hondo basin twelve irrigation ditches (acequias) have 6,836 acre-feet of diversion water rights for 2,735.7 acres of land; consumptive use rights are 3,424 AFY in a full-supply year. To meet this demand the Rio Hondo would need to sustain a flow of 15 to 20 cfs at the Valdez gage. As shown by Figure 6-2, flows of this size have never been common late in the irrigation season and the situation has worsened considerably due to the overall reduction in stream flow. A water storage project of some type would be required to accommodate all irrigation needs of the valley (Wilson, 1978). Small amounts of surface water are used for domestic purposes. Some domestic supplies come from six mutual domestic water systems (including the Twining System) which collectively divert about 190 AFY and consume about 57 AFY. The remaining, larger portion of the domestic supply is provided by individual wells, which are estimated to account for a diversion of about 342 AFY and consumption of 103 AFY. Miscellaneous water uses, such as for stock watering, fish and wildlife, etc., divert 19 AFY, 18 of which is consumed. Total diversion is thus 7,387 AFY with consumption calculated at 3,602 AFY. Irrigation accounts for 95 percent of total consumptive use. The total water needs of the area are significantly less than runoff in the Rio Hondo, even in a dry year. The main problem is, as shown in Figure 6-2, that too much of the runoff occurs in too short a time and there is not enough water late in the irrigation season. The only practical solution to this problem is construction of a storage reservoir above Valdez; such reservoir was evaluated and rejected (for reasons of geology and economics) in a study made by the Bureau of Reclamation (Wilson, 1978).

Additional data regarding water use are given in Wilson (1980). This reference projects future uses in the area. The major change is expected to be an increase in domestic use amounting to 18 additional acre-feet consumptive use from domestic wells and a 10 AFY increase for mutual domestic systems. These numbers are only approximate, but do indicate that even with expected growth (and possible additional retirement of water rights), irrigation will still account for 94 percent of the authorized consumptive use in the basin.

6.2.5 Impacts of the No-Action Alternative

The no-action alternative would provide no improvement in water quality; this is the principal reason why it is considered unacceptable. Most and perhaps all of the impacts of growth (see 6.2.7) may occur with or without any improvements to TWSD's wastewater management system. Implementation of the TSV, Inc. master plan would have substantial potential effects on non-point source pollution, which would be offset by mitigation measures to be enforced by the Forest Service. Additional trails would increase runoff slightly (nearly 80 AFY in the long-run).

6.2.6 Impacts of Treatment Alternatives

This section emphasizes two subjects: water-resource impacts which were a major cause for the rejection of many of the treatment alternatives and which were not fully explained in section 5.2; and the impacts which relate to those alternatives still being considered.

Regional Alternatives: Water-Rights Impacts. Most regional alternatives would remove TWSD's wastewater from the watershed; the District would need water rights to offset this impact and 'keep the river whole'. Based on the calculations made here, approximately 22 AFY of consumptive use rights would be needed if all existing return flows were eliminated. This negative impact is a major reason why public testimony opposed the regional options.

Snowmaking: Water-Quality Impacts. The water-quality impacts of snowmaking (alternative 15A) are difficult to analyze. The assumption is that the effluent from a treatment process such as alternative 1 would be very clean, containing only small amounts of pollutants such as phosphorus. If Twining remains a typical ski resort, the major discharge of effluent would occur in winter (December-March). If effluent is used for snowmaking, the discharge period would change to the spring melt/runoff season (March-June). The impact of this change depends on the rate of runoff during the spring melt season.

If the effluent-snow melts slowly, the pollutants will be adequately diluted by river flows and there will be no violation of standards. If the melt is fast then pollutants may reach the river too rapidly (that is, faster than would be allowed by the standards).

To evaluate water quality conditions, a worst-case analysis was performed, with the following assumptions:

1. 40 acre-feet of wastewater would be used for snowmaking during the winter (this represents a year of reasonably good business);
2. due to its relatively low elevation and greater solar exposure, the snow containing the wastewater will melt off early in the runoff season (specifically over a 60-day period in March and April);
3. there is no phosphorus removal during runoff.

Calculations made on the basis of these assumptions show that stream standards would be exceeded (Wilson, 1981). The same conclusion is reached for another worst case, in which the runoff occurs in wetter months (May or June), but over a 30-day period instead of sixty days. In short, if a winter's worth of phosphorus reaches the stream during a relatively short period in the runoff season, there will be too much phosphorus in the river. By definition a worst-case analysis may overstate impacts; for example, snowmaking snow is used as a base and has a tendency, because of its density, to melt slower than natural snow. However, the analysis suggests that it would be extremely difficult to guarantee success in the use of a large-scale snowmaking alternative. In particular, there is a significant probability that the phosphorus from four to five months of resort activity might reach the river in one to two months of runoff.

Snowmaking: Water-Supply Impacts. Snowmaking has three separate effects on water supply.

1. About 40 AF of wastewater would be discharged during the spring runoff season instead of the winter low-flow season. If the runoff occurs in a 30-day period (see assumptions in water quality discussion) and if that 30-day period was the driest runoff month in recent history, then the effect of snowmaking would be to increase the water supplies available downstream by 2 percent, a small but not trivial amount. In a more typical (median) year, the effect is somewhat less than 1 percent. In most years, not all of the early runoff is diverted downstream and there would be few if any benefits from the increased runoff.

2. A portion of the snow would evaporate (or sublimate) prior to runoff. This would reduce the amount of water available in the Rio Hondo late in the irrigation season. TWSD would have to obtain and transfer water rights in order to offset this effect; as discussed previously, such transfers are considered to have a significant adverse socio-economic impact.

3. In very wet years, the effect is to increase what may already be excessive (flood flows). The actual size of the effect would be on the order of

0.2 percent, an amount so small that there should be no increased flood hazard.

All these effects occur from conventional snowmaking (using fresh river water).

Total Recycling: Impacts on Water Supply. Total recycling (alternative 13) is often viewed as a technique to promote water conservation. However, it actually does not change river flows as the following chart shows. (For convenience, the chart assumes a water need of 100 AFY; this arbitrary number is not intended to be a projection of actual water requirements).

	Normal Water System	Recycling System
1. Water needed	100	100
2. Recycled water (=8)	0	70
3. Diversions (1-2)	100	30
4. Water available (2+3)	100	100
5. Consumed (assume 30% of 1)	30	30
6. Wastewater (4-5)	70	70
7. Returned to stream	70	0
8. Recycled to system (6-7)	0	70
9. Diversions - Returns (3-7)	30	30
10. Decreased stream flow (=9)	30	30

Both water systems decrease stream flow by 30 acre-feet. The only difference is that total recycling eliminates the water-quality effects of water use.

Impacts of Total Recycling on Public Health. EPA and EID regulations and policy prohibits the direct recycling of treated wastewater into a drinking water system, on the basis that it poses unacceptable risks to public health. Thus, alternative 13 could not be implemented. Citizens have questioned why the same logic does not apply to discharge of the wastewater to the river, where it may become a drinking water supply downstream. This question is difficult to answer, for as a recent EPA-sponsored project has shown, the water-resource community applies a double standard when it comes to defining the safety of drinking water (see EIS on the Northeast El Paso Wastewater Facilities, EPA, 1980). The most critical problem of direct recycling is that virus survival and infection may be higher if reclaimed water is put directly into a water system and consumed shortly after the wastewater was treated than if the same water is discharged to a river and not consumed for many hours or several days. Otherwise, differences in the regulation of direct recycling versus use of a river which receives some wastewater are based largely on psychology. This difference in attitude is widely described in the water-resource literature. Increasingly, it is stated that a single standard for 'safe' water is needed, which would probably allow direct recycling (if virus removal can be assured), since any other standard would render unacceptable the many water supplies which divert rivers which contain some wastes.

Impacts of Improved Treatment on River Quality. The alternatives still considered potentially the most cost-effective (numbers 1, 2 and 12) all produce effluent of similar quality, capable of meeting the standards listed in Table 4-1. If the facilities are properly designed, built and operated there should be no violations of the stream standards as a result of TWSD's discharge.

There are three major improvements in water quality which can be expected from the new facilities. First, there are many contaminants which should be controlled by the existing facility, but for which violations occur due to limitations in facility design, construction and/or operation. A new (or remodeled) facility should virtually end these violations and in general produce a better quality and more consistent effluent than the present plant. Second, the improved disinfection processes should significantly improve stream sanitation, through a more effective bacteria, virus and parasite kill. Third, the present violations of the phosphorus standards should end. However, because: a) non-point sources are significant; and b) the stream standards do not mandate pure water, the river would not be completely clean.

The improved water quality should produce an improved stream ecology within one or two years. The ecology of the river below TWSD would improve but remain somewhat degraded when compared to natural conditions (see section 6.4.3). This degradation results from the presence of the resort complex and could be ended only by complete control/treatment of all runoff from all development in the area. Algal growth in downstream areas would be reduced but not eliminated. Complete elimination of such growth, if possible at all, would require not only complete controls of pollution within TWSD, but comparable controls downstream. However, complete algal suppression is not desirable, since algae are a food source for fish and other organisms. Some algal growth is beneficial. Even with the very major improvement in river sanitation, the river will be a safe source of drinking water only if it is properly disinfected. Similarly, direct contact recreation would still pose a very small risk of health impacts.

A major concern of downstream residents is whether or not the reduction in phosphorus discharged from TWSD is sufficient to protect the lower part of the river, if and when there is growth in that area. EID has assessed this point by estimating the 'unused phosphorus wasteload allocation' which will be available in the lower valley once new facilities in Twining are in compliance with the regulations. The results are given in Appendix C.7. It appears that 25 to 50 percent of the downstream phosphorus allocation has in effect been allocated to Twining. EID concludes that this allows for considerable downstream development before there is a threat to the stream standards (Tague, 1981). However, as noted in the Appendix, a worst-case analysis suggests that if downstream wasteloads are not carefully controlled, there could be significant deterioration in water quality in the lower Rio Hondo within several years, possibly to the point that standards would be violated. In particular, the present policy of not requiring phosphorus control on new point sources (e.g. Hacienda condominiums) could use up the waste assimilation capacity of the river very quickly.

6.2.7 Impacts of Capacity Alternatives

Water Quality. Development in Twining increases the total volume of sewage which must be treated. With increasing volume comes: increasing costs of treatment; increasing need for reliable technology; and increasing impacts if treatment is ineffective. However, the basic premise of the water-quality regulations is that enforcement will assure that the costs are paid, that reliability is an accomplished fact, and that the impacts do not occur. For this reason, the probability is that plant size will not directly influence water quality.

Development will increase non-point source loadings, however, which could cause deterioration of water quality. The control programs (such as runoff management) discussed in section 5.4 would be intended to minimize this impact. If they are implemented and work as intended, the quality of the Rio Hondo should improve over and beyond the effects of having a better treatment plant. If the programs don't work, there would be degradation of the river (see 6.4.3). However, in the case of the most critical pollutant, phosphorus, this impact would not exceed the degradation allowed by the state stream standards. This is because the wasteload allocations (Appendix B.4) are based on a worst case and assume a doubling of pollution from non-point sources as well as a plant no larger than 95,000 gpd.

One special non-point source is lead and other contaminants in vehicle exhausts. Section 6.3.4 indicates that traffic levels along Highway 150 may double over the next several years (mostly because of off-peak traffic, not an enlarged treatment plant). This would double pollutant loadings which might reach the Rio Hondo (although this would be partly offset as a higher portion of the cars have modern pollution controls). While the change is adverse, based on the existing impacts of traffic (see Appendix C.5), lead and related types of contaminants would still be at barely detectable levels in the river, and not at concentrations for which health or ecological problems are of concern.

Water Supply. The water-supply needs of Twining, and especially water rights requirements, are certain to increase as a result of increased off-peak visitation, cabin development, and (if alternative E is adopted) an increase in the skier limit and commercial overnight facilities. Expansion of snowmaking would also have a significant impact if and when it occurs. Adoption of water-conservation measures (see 5.4.6) is the primary means of mitigating the impact.

The following chart indicates future water rights requirements (in acre-feet per year) of TWSD and/or TSV, Inc. if: a) development occurs to the level compatible with a 95,000 gpd plant); b) snowmaking efforts double as compared to present levels (and WRD does not change its position that snowmaking has a 30 percent consumptive use); c) water conservation is extremely effective, and all new development requires one-third less water than existing development; and d) there is no major increase in water used for by-pass (this might be true if pipes are buried sufficiently).

	Domestic	By-Pass	Snowmaking	Total Water Use
Diversions (AFY)	75.5	105 - 500	10	180.5 - 580.5
Return Flow (AFY)	52.9	105 - 500	7	158.4 - 558.4
Consumption(AFY)	22.6	0	3	25.6

The total increase in consumptive use would be from 10.8 acre-feet per year at present (including snowmaking) to 25.6 AFY. Of this, 4.9 AFY would be avoided if alternative B (80,000 gpd) is selected instead of alternative E (assuming that somehow this choice would prevent growth). That is, most of the increase is due to off-peak visitation, cabin development and snowmaking; relatively little is caused by increases in the skier limit and expanded overnight capacity. On the other hand, should Twining become a yearround resort, water consumption could be 5 AFY more than indicated above.

The State Engineer will not allow this increased consumptive use unless: a) it is accomplished by individual domestic wells which have an inherent water right of 3 AFY; or b) it is offset by the transfer (retirement) of surface water rights in an amount equal to the effect. TWSD does not propose to use domestic wells, and therefore must transfer water rights. The increase in domestic consumptive use is less than the quantity of San Juan-Chama Project water rights held by TWSD. The increase in total consumptive use is less than the calculated value of TSV, Inc.'s water rights. Thus, there are two ways of offsetting the increased use.

1. The increased consumption of river water could be offset by full use of San Juan-Chama Project water only in winter, when there is no shortage of water downstream. Summer use would have to be offset by a small retirement (transfer) of the TSV, Inc. rights, amounting to two to three acres of irrigated land along the Rebulse Ditch.

2. Or, the increased use could be offset by transfer of essentially all 18.94 AFY of TSV, Inc.'s consumptive use water rights.

Either approach is likely to be protested by one or more owners of Rio Hondo water rights. Based on principles of water-rights management established by the State Engineer, both methods are likely to be approved (and the second one is virtually certain to be approved). In either case, if TWSD is successful in implementing water conservation measures (dry toilets or extremely low-flush toilets), there would be no need to acquire additional water rights in the Hondo Valley so long as growth does not exceed that which is allowed by alternative E. This situation could change if a water-master is appointed and the rights available to the District are found to be junior to those in Arroyo Hondo. In such a case, the District might need to obtain and retire rights from Arroyo Hondo in order to be assured of a full water supply in years of limited runoff. The impacts of retiring irrigated lands are discussed in section 6.6.6.

Considerable public comment has been expressed because of the uncertainty about exactly which water rights might be used in the resort area and the prospect that potential transfers might not be approved by the State Engineer. Also, the above projections assume that TWSD continues to use the Pattison water right; if use of this right is lost then the need for water rights would increase by 10.91 AFY. The principle concern is that, if there are problems in use of any of the existing rights, TWSD, TSV, Inc. or others might become aggressively involved in the acquisition of new rights and the retirement of additional irrigated land.

There would be no additional impact if TWSD shifts from surface to ground water as its source of supply. As discussed in section 6.2.3, pumping effects are transmitted to the river very quickly; hydrologically, the two types of diversion are very similar. Because the well use is balanced fully by reductions in Rio Hondo river flows it does not have a significant effect on the regional ground-water table or on river flows or lake levels in other basins. Thus, for example, pumping in Twining would have no impact on water levels in Blue Lake (see section 6.5).

If the skier limit is raised to 4800, there would be some additional overnight development outside TWSD; it is estimated this would require about 1 to 2 AFY of consumptive use somewhere in the Taos region. (If the limit is raised but there is no new overnight capacity in Twining, the impact outside the District would total 6 or 7 AFY.) The water-rights impact of this development would vary depending upon location and type of facility. For example, if motels in Taos expand to accommodate the additional skiers, the town's San Juan-Chama rights could provide all of the needed supply. If development is outside Taos, there could be a need to retire a few acres of irrigated land (the basin affected would depend on the site of the new lodge/condo etc.). Or, the facilities might use the domestic water right of 3 AFY, in which case no irrigated land would be retired; rather, there would be a depletion of stream flow up to 3 AFY.

Just as past development in Twining is not the cause of the decline in river flow, future development on any of the scales discussed here would not be a factor controlling future amounts of runoff. Any solution of this problem - or of problems such as the protection of farmland against water-rights transfers could occur only through comprehensive planning directed at the local level and involving appropriate state and federal agencies.

6.2.8 Impacts of Other Types of Alternatives

Major impacts from the other types of alternatives would include the following: a) Any efforts to upgrade OSS management are likely to be reflected in improved ground and surface water quality. b) The superior disinfection processes proposed will definitely benefit stream sanitation. c) Water conservation measures are essential if TWSD is to maximize its development within the limits of wastewater plant capacity and available water rights. d) Quality assurance measures would be expected to improve the probability of compliance with the stream standards. e) Measures such as a continued ban on phosphorus detergents would benefit plant performance and river quality.

Programs to control non-point sources (primarily those described in USFS, 1981a and 1981b) have the potential to significantly improve river quality by reducing pollutant loadings from ski trails, parking lots, the base area and construction sites. However, it must be recognized that these sources are one cause of degradation. Unless the programs reduce loadings to well below existing levels, it can be expected that the river will show the continued ecological changes associated with resort development. These impacts would include elevated levels of most pollutants as the river flows through the base area, and possible occasional violations of the turbidity standard if runoff is not adequately controlled from areas of disturbed soil. The extent of these effects will be reduced in direct relationship to the success of mitigation measures.

6.2.9 Impacts of EPA and Other Agency Alternatives

EPA funding of new treatment facilities would benefit the quality of the Rio Hondo; otherwise, EPA's choice of funding alternatives would have no identifiable impact on water. Assuming that a new facility works as intended, the decisions of other agencies may actually have a more important effect on the long-term water resources of the area. The watershed management programs of USFS may be able to have a small influence on runoff and possibly stabilize or improve downstream water supplies. Comprehensive protection of water rights for the land would require countywide programs with this objective. Provided that the non-point source control programs of USFS (and TWSD) work well, the upper reaches of the river would be expected to show long-term improvement compared to existing conditions. Possible violations of stream standards in the lower reaches are appropriate for consideration in future EID decisions regarding NPDES permits, on-site systems regulations, and the general subject of non-point source controls.

6.3 AIR QUALITY; NOISE

6.3.1 Existing Conditions

Air Quality. The USFS EIS (USFS, 1981a and 1981b) evaluates present and future air quality impacts associated with expansion and other modifications of Taos Ski Valley, Inc. The analysis and conclusions apply to this EIS and are presented here in summary form.

Taos County has naturally very clean air which is potentially affected by vehicle exhaust emissions, dust from various sources, and wood smoke. Limited data on air quality are available for the area; the data indicate the only existing problem is excessive suspended particulates, attributed to windstorms. Strict federal and state regulations are intended to prevent any major change in the existing conditions. The Wheeler Peak Wilderness Area (see chapter 6.5) is designated a Class I air quality area in which no significant deterioration of existing air quality is allowed. The remainder of the county, including TWSD, is Class II, which allows some deterioration (12 percent of the standard). Baseline data for Twining and downstream communities does not exist. However, air quality modeling done for the Forest Service EIS indicates that most standards are not now exceeded or will be exceeded in the near future. Total suspended particulate levels (dust) are often exceeded in New Mexico due to natural conditions. Ambient air quality standards are listed below.

	New Mexico Standard	Federal Primary Standard	Federal Secondary Standard	Estimated Existing levels at Twining
Total Suspended Particulate (TSP)				
1. 24-Hour Average	150 ug/m^3	260 ug/m^3	150 ug/m^3	-
2. Annual Geometric Mean	60 ug/m^3	75 ug/m^3	60 ug/m^3	-
Carbon Monoxide (CO)				
1. 8-Hour Average	8.7 ppm	9 ppm	9 ppm	-
2. 1-Hour Average	13.1 ppm	35 ppm	35 ppm	.19 ppm
Non-methane Hydrocarbons (HC)				
1. 3-Hour Average	.19 ppm	n/a	n/a	.0074 ppm

New Mexico Ambient Air Quality Standards are as set forth in section number 201 of the "Ambient Air Quality Standards and Air Quality Control Regualtions." Federal Ambient Air Quality Primary and Secondary Standards are provided by the National Ambient Air Quality Standards (NAAQS) as established by the Environmental Protection Agency. State and federal annual standards are not to be exceeded at all, while federal short-term standards are not to be exceeded more than once a year.

Definitions of federal ambient air quality primary and secondary standards are as follows:

> "National primary ambient air quality standards define levels of air quality which the Administrator judges are necessary, with an adequate margin of safety, to protect the public health. National secondary ambient air quality standards define levels of air quality which the Administrator judges necessary to protect the public welfare from any known or anticipated adverse effects of a pollutant."

There are no significant sources of air pollutants generated at the existing sewage treatment plant. Plant odors have not been a major problem, at least partly because of the remote location of the facility. Impacts from traffic are well below the standards; see 6.3.4.

Noise. There are no persistent or unusual sources of noise in TWSD or along Highway 150. Residential noise levels in TWSD and the Hondo Valley would be expected to be typical of rural areas, on the order of 35 to 45 decibels (A-scale) and perhaps a few decibels higher near the highway (EPA, 1978). The equipment at the existing sewage treatment plant is typical of a relatively quiet facility, and is thus about 40 to 50 decibels at the property line.

6.3.2 Impacts of the No-Action Alternative

Air pollutant emissions and noise would increase due to increased off-peak travel to TWSD. These impacts are discussed in section 6.3.4.

6.3.3 Impacts of Treatment Alternatives

New treatment facilities would be generally similar to the existing facilities with regard to generation of air pollutants and noise, except: the addition of a stand-by generator (to be used in the event of power failures) would add one new source of exhaust and noise, and the air blowers for aerating the activated sludge are relatively noisy; however, they would have silencers and would be housed inside the plant building. The impacts of this equipment would be detectable only in the immediate vicinity of the plant and are considered minor.

Short-term impacts on sound and air quality would occur from construction and will differ according to which alternative is selected (see Table 6-1). Alternatives which involve piping sewage from Twining would affect the largest area and greatest number of people. Alternatives which call for construction at each cabin and lodge (e.g. composting toilets) would have the greatest impact on sound and air quality within the ski valley.

6.3.4 Impacts of Capacity Alternatives

Mountain valleys are often sensitive to air pollution (Reeser and Kirkpatrick, undated), although in the Hondo Valley the wind regime appears to be favorable to the dispersion of pollutants. A major potential impact on air quality is increased exhaust emissions from increased vehicle traffic. USFS (1981a and 1981b) presents the results of two 'worst-case' modeling studies which predict the increase in carbon monoxide and hydrocarbon pollution along Highway 150 as a result of projected increases in traffic to and from the resort complex. The magnitude of the traffic increase is comparable to that identified in section 6.6 of this EIS. Average traffic levels are expected to increase approximately 88 percent even if ticket sales are limited to current levels (alternative B, 80,000 gpd). If alternative E (95,000 gpd) is selected, average traffic is expected to increase by 123 percent and peak traffic by 20 percent.

The impact of traffic on air quality can be considered in two aspects. "Average" pollutant concentration will be related to average traffic flows, of the total number of vehicle trips over a long period. "Peak" pollutant concentration will occur during rush-hour conditions - relatively short periods in the morning and in the evening when large numbers of cars are on the road. Such peak concentrations are much higher than the average pollutant concentration. Using the traffic numbers given in Table 6-8, average air pollutant concentration during the ski season would increase by 88 to 123 percent. Peak concentration would increase by no more than twenty percent. However, the modeling presented in USFS (1981a and 1981b) indicates that even under worst-case conditions (peak traffic, low wind speeds) the increased traffic would produce concentrations of carbon monoxide and hydrocarbons that are well within limits established by state and federal standards. (These projected increases assume a linear relationship between vehicle numbers and pollutant emissions; however, the increase will probably be less due to emissions controls placed on newer automobiles). Some of the pollutants may be washed into the Rio Hondo and could affect water quality; as illustrated by calculations for lead (see Appendix C.5), this impact would be very small.

Romero (1978) analyzed air pollution in the ski resort of Vail, Colorado, and found possible visibility and health impacts from fireplace emissions. The population at Vail is much greater than in Twining, and the cause-effect relationships between air quality and wood smoke were not well-established. The principal implication of this study is that fireplace emissions could become a concern in Twining if population increases toward the upper limit of the projections presented in Table 6-7 (148,000 gpd plant).

There would be an increase in noise along the highway due to the traffic increase (see Table 6-8). The increase at 100 feet from the road would be 1 to 3 decibels, averaged over 24 hours (Wilson, 1981). There would be short-term impacts on both noise and air quality from construction activities associated with development in the ski basin (see Table 6-1). Such impacts would be somewhat greater for the larger capacity alternative.

6.3.5 Impacts of Other Alternatives

Construction activities associated with each alternative would have short-term impacts on noise and air quality (see Table 6-1). Section 6.1.3

discusses the relative magnitude of construction activities for the various alternatives.

Ozone, which would be used for disinfection under alternatives 1, 2, 12 and 15, is a toxic gas. However, it would be generated on-site in small quantities for immediate use; therefore, the accidental release of a large amount of ozone would not be expected. The ozone generator and dosing chamber are closed systems which should contain all ozone. If any leaks occur, they would be detected by the characteristic ozone odor, which is noticed at levels below the toxicity concentration. In general, the hazard to the community of ozone use are considered less than for the alternative, chlorine.

6.3.6 Impacts of EPA and Other Agency Alternatives

The major impact on air quality and noise would be from increased vehicle traffic. Some deterioration of air quality is likely regardless of what funding decision EPA may make but in no case is it projected that air quality standards would be exceeded. Actions by other agencies to require or encourage use of a shuttle system could lead to improved air quality.

6.4 BIOLOGICAL RESOURCES

6.4.1 Existing Conditions

Terrestrial biology. Animal species that are likely to reside in Taos Ski Valley or adjacent areas are listed in Appendix 9 of the U.S. Forest Service EIS (USFS, 1981a and 1981b). The mountains support a good variety and population of many mammal, bird and other species, including mule deer, mountain lion, black bear and mountain sheep.

The principal vegetation in the base area is a forest of quaking aspen and dense spruce-fir trees with small stringers of riparian vegetation along the stream courses. Up-mountain, a dense spruce-fir forest covers the landscape, with mixed stands of aspen overstory and spruce-fir understory. Alpine tundra occurs above timberline (approximately 11,800 feet). Large areas of rock outcrop and talus slopes are devoid of vegetation. Mountain meadow and subalpine grasslands, both natural and man-caused, are interspersed throughout the forest. Appendix 3 of USFS (1981a) provides a plant checklist.

Approximately 281 acres of ski trails are vegetated with a mixture of native and introduced grass and forb species. Because vegetative cover has a prime value of stabilizing and reducing soil loss from erosion, efforts have been made to revegetate lift corridors and trails. Fertilizers have accelerated the recovery time of the vegetative cover and reduced the potential soil loss.

Aquatic Biology. The Rio Hondo is an important cold-water fishery which contains a variety of fish species. These include brown trout, which in the past have been predominant in the lower sections of the river; cutthroat trout, mostly in upper sections; rainbow trout, which are stocked every year; brook trout and dace. There are also a number of hybrid rainbow-cutthroats in the river. These fish feed on a variety of lower-life forms, especially relatively large invertebrates which dwell on the river bottom. Appendix C.8 provides a checklist of these benthic macroinvertebrates. Much of the river is considered a high-quality ecosystem; however the portion of the river in and near Twining has been degraded by effluent from the resort complex (see below).

Historic Impacts of TWSD and Taos Ski Valley. In 1979 EID began to sample benthic macroinvertebartes in the stream bottom of the Rio Hondo in order to evaluate the ecologic impacts of effluent from the TWSD treatment plant. The studies determined the relative abundance of two types of organisms: relatively good food sources which require a clean stream for reproduction (example: mayflies and stonefiles); and less satisfactory food sources which are tolerant of a somewhat mucky stream bottom (example: true flies). Unless sewage is well-treated, it stimulates algal growth and contributes settleable solids which can damage a clean, rubble stream bottom and lead to a change in ecology from the first type of species to the second. (The change may actually produce a greater abundance of aquatic organisms; the impact is one of quality of biomass, not quantity). A second aspect of the study was the measurement of chlorophyll a, which indicates the relative growth of algae and is thus a direct measure of whether or not the river is overfertilized (too many nutrients).

EID has taken biological samples at three stations: HON4, HON8, and HON12 (see Figure 6-3). This provides information on the aquatic habitat above and below the treatment plant, and at a point 10 kilometers (6 miles) downstream of the treatment plant but still within the mountain segment. Samples have been taken in the spring (after the stream has received the greatest concentration of sewage effluent), in the summer (after the spring scour), and in the fall (before the beginning of the ski season).

The data from the samples have been analyzed by Dr. Gerald Jacobi of EID using the biological community index (BCI). The BCI was developed specifically for high mountain streams as an indication of their biological health. Calculation of the BCI involves comparison of what is actually found in the stream to what should be there (based on stream gradient and water chemistry). Using this approach, the results for the Rio Hondo can be summarized as follows (see Figure 6-3 for location of stations):

BIOLOGICAL CONDITION

	HON4	HON8	HON12
March, 1979	Good	Poor	Good
July, 1979	Good	Good	Good
November, 1979	Moderate	Moderate	Good
March, 1980	Moderate	Poor	Good

Algae samples were also taken by EID from rocks at stations HON3 through HON12 and analyzed for chlorophyll a in November 1979, March and May, 1980. The highest levels were found at HON8 in March and at HON10 in November.

The results of the sampling show that during the ski season, nutrients and solids from the treatment plant seriously degrade the Rio Hondo immediately below the treatment plant (Jacobi, 1979; Jacobi, 1981; Jacobi, et al., 1980). The spring scour cleans away the accumulated pollutants and the aquatic biology is able to recover. The data show that some degradation is occurring above the treatment plant due to non-point sources, especially during low-flow periods. The high levels of chlorophyll a at HON10 prior to the ski season in November suggests that algae, fed by nutrients from the sewage plant, grow in the stream right below the plant through the winter and are then carried downstream after the spring flows scour out the area. However, the low chlorophyll a levels at HON 12 neither confirm nor deny theories that this scour may have an impact in the lower Valley area.

The data for more recent samples are still being analyzed; generally the same patterns have been seen. Conditions at HON8 were particularly poor this past winter (1981); all organisms were virtually eliminated, apparently due to over-chlorination by the treatment plant.

Although the stream biology has been able to recuperate each year after the spring scour, EID is concerned about what might happen in a low-flow year in which there is no scour. In such a case, the degradation of the stream might spread further down, and the environment might be stressed past its ability to be easily restored to high-quality conditions.

The New Mexico Department of Game and Fish has expressed concern over the potential problems in the Rio Hondo due to Twining's discharge. It is believed that under historic conditions the river has been becoming a marginal stream for the cutthroat trout, a sensitive species considered to be "threatened", by the State of New Mexico (but not on the Federal Threatened and Endangered Species list), which requires pure, cold water. Further degradation of the Rio Hondo due to non-point sources and/or sewage discharge may make the stream unsuitable for the sensitive cutthroat. There is already evidence for increased cross-breeding between cutthroats and rainbow trout; such cross-breeding is indicative of stressed conditions (McNall, 1981). Brown trout, which are more tolerant of polluted streams, and which even feed on the cutthroats, have invaded the upper portions of the Rio Hondo as high as one mile above Valdez. It is the position of Warren J. McNall, Assistant Director over Fisheries Research and Management, that continued violation of the discharge permit at Twining would eventually render the upper Rio Hondo unsuitable for native fishes and possibly even for the planted rainbows (McNall, 1980). However, the converse is not necessarily true; restoration of a clean stream would not in itself assure survival of the cutthroat against the pressures of other species.

The Department has received increasing numbers of complaints that there are fewer fish in the river than in previous years, that dead fish are more frequently seen, and that the fish that are there taste bad, look sick and slimy, and have skin lesions. It has also been noted that ducks and geese are seen less frequently and that vegetation is dying along the river. Algal growth in the river has reportedly become a nuisance for downstream recreational and farming activities. These complaints have been investigated, but with the possible exception of the algal growth, no relationship to TWSD sewage discharge has been found. (See also section 6.2.2 and Appendix C.4.).

Threatened or Endangered Species. In accordance with Section 7(c) of the Endangered Species Act, as amended, EPA requested that the U.S. Fish and Wildlife Service identify any plant or animal species in the area that is listed, or proposed for listing, as endangered. The FWS list was provided to EPA on October 12, 1979, and is as follows (USDI, 1979a).

"LISTED SPECIES

Bald eagle (Haliaeetus leucocephalus): May be found as a winter resident and or migrant along the Rio Grande and tributaries. Also recorded in the Sangre de Cristo Mountain area in summer. This water-oriented eagle feeds largely on fish though also takes waterbirds and mammals.

Peregrine falcon (Falco peregrinus): This species, a summer resident of the area, typically hunts waterways for food. Nest sites are associated with cliffs and bluffs of gentle terrain.

PROPOSED

None.

CRITICAL HABITAT

None."

Information provided by the Forest Service (USFS, 1979a) indicates that the bald eagle has been sighted in the canyon twice in three years; therefore, it is unlikely that the bird is greatly dependent upon this habitat. The Forest Service suspects that it is transitory and only uses Hondo Canyon in a fashion similar to a fly way (USFS, 1979).

The peregrine falcon has been observed hunting in the near vicinity of the Rio Hondo, but there has been no direct observation of peregrines or evidence of breeding documented in the watershed itself. Prey ranges from swallows to ducks, geese, and herons, and in New Mexico they commonly feed on jays, woodpeckers and band-tailed pigeons (EPA, 1980b; Dick-Peddie, 1978). Breeding takes place in mountainous areas relatively near water on cliffs or other high structures. The Forest Service feels there is a strong possibility that the birds use the drainage for hunting; however, it is doubtful that they are wholly dependent on this habitat (USFS, 1979a).

The cutthroat trout was listed on the Federal endangered species list in 1962. Although it has since been taken off that list, it is considered a sensitive species in the state of New Mexico. Two state-threatened animals suspected of occurring in the area are the white-tailed ptarmigan and the pine martin, although no sightings of the pine martin have been reported in recent years.

No threatened or endangered plant species occur within the boundaries of the District. However, several species regarded as "sensitive and rare" by the New Mexico Heritage Program have been found in the area (USFS, 1981b; Isaacs, 1981). The bunchberry, Cornus canadensis, is found within District boundaries, which is one of only two locations known for this species in New Mexico. The stiff club moss, Lycopodium annotinum, is found along Lake Fork of the Rio Hondo and is the only known location for the species in the state. Possibly within District boundaries may be found the pale coral root, Corallorhiza trifida, another sensitive species. None of these plants are in areas of present or planned development.

6.4.2 Impacts of the No-Action Alternative

If no attempts are made to improve the water quality of the Rio Hondo there will be no change in the existing aquatic conditions, in which degradation is already evident below the treatment plant. With or without changes in the wastewater treatment system, some further growth is anticipated in the resort. Such growth would be expected to substantially increase non-point source pollution from on-site systems and therefore cause continued deterioration of the stream ecology. As mentioned above (6.4.1), there is the fear that a low-flow year with no scour would prevent the restoration of high quality aquatic conditions in the spring and result in increased degradation further downstream.

6.4.3 Impacts of Treatment Alternatives

Improvement in the treatment facilities at TWSD should virtually eliminate stream standard violations and produce a better quality effluent, as discussed in 6.2.6. This would have a favorable impact upon stream ecology; however, because of non-point sources of pollution from the resort complex, and the fact that meeting the stream standards does not guarantee a pristine river, biological conditions would be expected to improve only from poor to moderate at HON8 in the spring and perhaps from moderate to good in the fall. Algal growth downstream would be reduced but not completely eliminated.

6.4.4 Impacts of Capacity Alternatives

Non-point source loadings would increase with further development in Twining and could contribute to deterioration of water quality. This impact should be minimized by the on-site system management program (see 5.4.2), which, if successful, has the potential to improve Rio Hondo water quality and ecology beyond the improvements expected from a more efficient treatment plant. If unsuccessful, however, further degradation of the river would occur.

6.4.5 Impacts of Other Types of Alternatives

Any type of upgraded OSS management would result in improved water quality, which will have a positive impact on stream biology. The use of ozonation in place of traditional chlorination for disinfection would eliminate the possibility of chlorine residuals which are toxic to aquatic life.

6.4.6 Summary of Impacts on Endangered and Threatened Species

The bald eagle (Haliaeetus leucocephalus) feeds primarily on fish and could potentially be effected if the quantity or quality of fish in the river is diminished due to lack of improvements in water quality. Also, continued increases in the tourist flow to the area could result in a very small decline in the size and value of the bird's habitat. However, because the effected area would be small and would not involve essential habitat, these impacts would not be significant.

The impacts on the peregrine falcon (Falco peregrinus) probably would not be significant either, since their presence in the area is questionable. Any decline in the wildlife (primarily avian) population could cause a decline in their habitat, but as in the case of the eagle, it is unlikely that these birds are greatly dependent upon this habitat.

The cutthroat trout may well be effected by the no-action alternative, since these fish require cold pure streams. Continued Twining discharge could cause significant reductions in the cutthroat population.

A decline in the wildlife population in the area could potentially cause a decline in the habitat of the pine marten; however, comparable habitats are generally widely available in the region, so the impact on this species is probably insignificant. Ptarmigan are birds of the alpine tundra and timberline habitats; therefore, impacts on this species would not be expected.

Since the plant species considered to be sensitive and rare do not occur in any developed areas or in areas of planned or potential development, no impacts would be expected from the no-action alternative (nor from the treatment, capacity or other alternatives).

6.4.7 Impacts of EPA and Other Agency Alternatives

EPA will support the biological upgrading of the Rio Hondo to the extent that funding is granted for treatment of existing or expanded future flows.

The non-point source programs of USFS (and TWSD) must be successful to assure improvement of biological conditions.

6.5 SENSITIVE RESOURCES

The Twining area contains a number of environmentally sensitive resources of both natural and cultural origin. These include historic/archaeologic resources, existing and potential wilderness areas, a wild and scenic river, sacred Indian lands, and a highly aesthetic visual resource. Figure 6-5 shows the location of many of these resources.

6.5.1 Existing Conditions

Historic and Archaeologic Resources. Historic and archaeologic resources in the Twining area are discussed in USFS (1981b). In summary, the continuous presence of Pueblo Indians has been evidenced in the TWSD area for at least the last millennium. It was not until the beginning of the 17th century that the Spanish began to settle in the vicinity and the 19th century before the first Anglos arrived. The town of Twining was established around 1900 by the Frazer Mountain Copper Company and a mine developed in the TSV area. Both Twining and the copper mine were abandoned in 1910 due to financial difficulties of the Frazer Company. Population was estimated to be between 500 and 800 during this decade. Presently a few buildings remain at the abandoned mine site. According to the New Mexico State Historic Preservation Officer, no properties registered, nominated or determined eligible for nomination to the Register of Historic Places lie within or adjacent to the treatment plant site (Merlan, 1981). See letter in Appendix E.

Compared to other regions in the state, there is a relatively low probability of archaeologic site occurrence in the TWSD area due to high elevation and steep slopes. If such sites do exist, they are likely to be seasonal hunting camps used by Archaic or Pueblo peoples between 5500 B.C. and A.D. 400. The sites would be simple in nature, consisting mainly of isolated stone tools or projectiles and would be easy to excavate (Schaafsma, 1981).

Wilderness. The Wheeler Peak Wilderness adjoins the TSV, Inc. permit area to the south and west; an additional part of the wilderness lies to the east of the area but does not border it. The New Mexico Wilderness Bill, passed Jan. 31, 1981 expanded the 5,127 acre tract to its present 19,800 acres and added rugged canyons and gentle subalpine meadows to the previously included alpine zone. The area is open to use for recreation and grazing and, until the end of 1983, mining and prospecting. At present, use is almost entirely for recreation and is heavy during the summer and light during the winter. Visitation in winter is limited due to steep slopes and avalanche hazards; however, there is some cross-country skiing and mountaineering, hiking, backpacking and winter camping (Moehn, 1981). One of the major trailheads to the Wheeler Peak Wilderness is the Bull of the Woods trail originating in Twining.

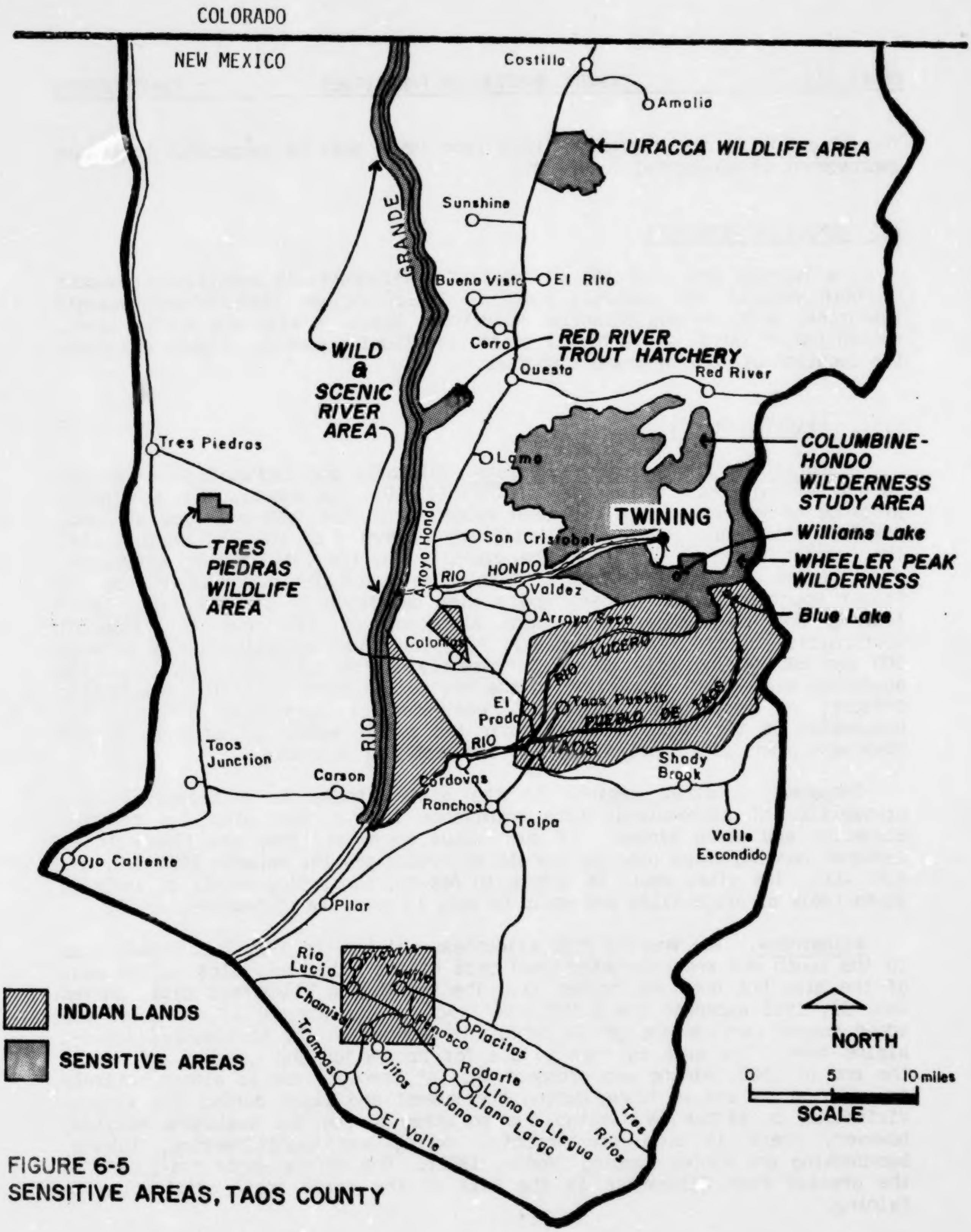


FIGURE 6-5
SENSITIVE AREAS, TAOS COUNTY

Columbine-Hondo (46,050 acres) lies to the north of TWSD and was designated as an area for further study in the 1981 New Mexico Wilderness Bill. It is an extensive alpine and subalpine area which provides important habitat for deer and elk; use is light at present (Moehn, 1981).

Wild and Scenic River. The Rio Grande from the Colorado state line to the confluence with the Rio Pueblo de Taos (48 miles; see Figure 6-5) was the first river to be designated as part of the National Wild and Scenic Rivers System created by Congress in 1968. This pristine reach of the stream is primarily managed by the Bureau of Land Management with the objective of maintaining it in its natural state. A portion of the Rio Grande runs through the southwest corner of Taos Indian Pueblo land and is administered by the Pueblo in a manner consistent with the National Wild and Scenic Rivers regulations.

Use of the Rio Grande Wild and Scenic River area is restricted to recreation only with no development permitted. Most recreational activities occur during summer months and include camping, fishing, hunting and rafting. Winter use is extremely light. The confluence of the Rio Hondo and Rio Grande (Dunn Bridge) is a heavy use area as this is a major entry point for river rafters. Other sensitive areas in Taos County include Uracca Wildlife Area, Tres Piedras Wildlife Area and Red River Trout Hatchery. These areas are shown in Figure 6.5.

Sacred Lands. Taos Pueblo Indian land lies to the south of TWSD, forming the southern border of the Wheeler Peak Wilderness Area. Although Taos Pueblo land is not adjacent to TWSD, the people of Taos Pueblo are generally concerned about trespass intrusion and other problems which may occur as the result of development in Twining. They are especially interested in protecting water resources, including the Rio Lucero (the basin adjacent to Rio Hondo) and Blue Lake, which is significant due to its sacred nature.

The Taos Pueblo people have a history of defending and preserving their land. They regard their land and all water sources as a gift from God and thus sacred. These sacred entities are protected by the American Indian Religious Freedom Act (1979) which guarantees access, preservation and protection for all religious properties held by Native American tribes. In the past, Taos Indians have had some problems with trespass violations and land disputes in border areas. It is especially important that sacred land remain in its natural state since the spiritual well-being of the site is believed to be dependent on its physical condition. It is also important that privacy be maintained to avoid disturbance of sacred rites. Appendix E contains a letter from Paul Bernal, Taos Pueblo Tribal Council Secretary, elaborating his concerns in relation to development in the Twining area.

Visual Resources. USFS (1981a; Appendix 8) contains a detailed analysis of visual resources in the Twining area. Briefly, the base area has been characterized as resembling a Swiss alpine village comprised of natural and man-made features including:

1. aspen tree trunks and buildings with pitched roofs, both creating strong vertical lines;

2. natural building materials with rough textures and earth colors;

3. long, narrow, well-defined spaces (usually for vehicle and pedestrian movement).

USFS uses a methodology called Visual Management System to assess the visual impacts of major projects. Under this system, the U.S. Forest Service has determined a visual quality objective for TSV, Inc., based on scenic attributes and the extent to which the area is visible to the public. Any modifications made to the ski area must comply with this objective. Basically, the objective permits management activities to TSV, Inc. which are not visually evident. Texture, color, line and form must be a repetition of what already exists in the characteristic landscape. 'Critical viewpoints' is one criterion evaluated in the Forest Service Visual Management System. Figure 5 of the U.S. "Z" document (USFS, 1981a) shows locations of critical viewpoints in the central base area. The sewage treatment plant is located to the west of the central base area off the main road. It is below other development thus out of sight from most recreational activities, but a limited view of it is present from the main road.

Agricultural lands. EPA has established a policy to protect environmentally significant agricultural lands wherever they may be impacted by agency programs. The policy is intended to minimize impacts which may induce conversion of agricultural land unless the proposed activity serves an essential public need (see Table 3-1). The irrigated lands of the lower Hondo valley can be considered as significant agricultural lands due to their importance to the traditional lifestyle of the area (see section 6.6.2).

6.5.2 Impacts of the No Action Alternative

Continued pollution of the Rio Hondo and waters downstream, possibly including the Rio Grande Wild and Scenic River area, would result if TWSD's discharges are not cleaned up. An outcome of increased population in the Twining area would be greater potential of trespass impacts to both sensitive Forest Service lands (especially Wheeler Peak Wilderness) and sacred Indian lands. In addition, potential visual impacts and possible archaeologic site disturbance impacts could result from growth-related activities such as cabin construction. The trespass, visual and archaeologic impacts are discussed in 6.5.4.

6.5.3 Impacts of Treatment Alternatives

Construction of a new treatment plant at the existing site (for example, alternatives 1, 2, and 13) would involve acquisition of an additional wooded acre of Forest Service land. Cutting of trees would result in much more visual exposure of the treatment plant. An archaeologic survey would be necessary prior to construction; salvage or even relocation might be needed if important resources are found. Should any sensitive historic or archeologic resources be located during construction, work would stop pending notification and decision of the State Historic Preservation Officer. Alternatives 1 and 13 call for construction of greenhouse-covered sand drying beds for sludge. Similarly, alternative 2 requires construction of a greenhouse-covered pond. Neither the pond nor drying beds would conform structurally to the characteristic landscape as described in the Forest Service Visual Management System (USFS, 1981a). Although this would be a potential visual impact, it would be nominal due to the low visibility of the plant area which is below all other development.

Any of the alternatives suggesting pipeline construction (6, 7, 8, 10, 11, 14) would have a greater visual impact and potential for disturbance of historic or archaeologic sites. The large holding ponds discussed in alternatives 6, 7, 9, and 14 would create a permanent visual impact in downstream areas. Construction of a pipeline to the Rio Grande (alternative 8) would cause additional problems due to the river's Wild and Scenic designation. Possible odors, solids and algae would create conflict due to the recreational nature of the Rio Grande at Dunn Bridge. Bureau of Land Management approval would be necessary prior to implementation of this alternative.

Alternatives 3 and 9 involve more clearing and thus greater potential for visual impact.

6.5.4 Impacts of Capacity Alternatives

No known archeologic sites or historically significant structures exist within the TWSD area. The few remaining buildings located at abandoned mine sites would not be affected by construction activities. New construction (cabins, condos, etc.) have some small potential to affect archaeologic sites on private land.

Any capacity alternative which supports greater visitation to TWSD during the winter season would increase the potential for use of the wilderness area. Due to hazardous winter conditions, however, increased usage of sensitive Forest Service areas such as Wheeler Peak Wilderness is unlikely. No adverse impact as a result of ski resort development is anticipated for the Rio Grande Wild and Scenic River area. Water quality of the Rio Grande would remain unchanged so long as a central plant complies with the standards.

Taos Indian Pueblo lands and TWSD are separated by the Wheeler Peak Wilderness Area. Carson National Forest staff have characterized this wilderness tract as an extremely light use area during winter due to steep slopes and potential avalanche dangers (Moehn, 1981). As influx of visitors to TWSD is primarily a winter phenomenon, the potential impact caused by trespass and desecration of Indian lands is considered remote. Additionally, none of the alternatives described in Chapter 5 affect the quality or quantity of waters on Indian lands, including the sacred Blue Lake. Refer to section 6.2 for further discussion of water resources.

Proposed modifications to TWSD beyond those discussed in USFS (1981a) would include construction of approximately 94 cabins to the east of the base area and addition of several large structures within the central base area. Construction in the base area and to the east would meet the Forest Service visual quality objective as long as the texture, color, line and form repeated those of already existing structures and the Swiss Alpine village appearance was retained. Many people have expressed a desire to preserve this Swiss village character of the area (USFS, 1981a). As most of TWSD is private land there is no guarantee that designs would be in compliance with Forest Service visual quality standards. Peer pressure in the area to keep the village appearance unchanged would be the principal motivation to encourage conforming design.

Agricultural lands would benefit from water-quality improvements regardless of treatment plant capacity. The use of water to support increased use of the resort complex (and/or snowmaking) could require retirement of up to 15.15 acres of water rights land. The necessary acreage is already owned by Taos Ski Valley, Inc. and represents less than 1 percent of the irrigated land in the valley.

6.5.5 Impacts of Other Types of Alternatives

Impacts of the remaining components for development of a complete wastewater system would be minimal. Rehabilitation of existing collection lines would create a short term visual impact as would sewer construction (see Table 6-1). Sewer extensions would create greater potential for historic or archeologic site disturbance as well; surveys will be required prior to construction.

6.5.6 Impacts of EPA and Other Agency Alternatives

Alternatives suggesting new plant construction would require negotiation with the Forest Service to obtain a permit for an additional acre of land. The Forest Service would require an environmental assessment be completed prior to construction.

No impacts are anticipated to sacred lands, potential and existing wilderness areas or the Rio Grande Wild and Scenic River area regardless of the alternative chosen. Development on private land may have a potential but probably minor impact on visual resources and archaeologic sites; these impacts would be similar under any EPA funding decision and would likely occur even if a new plant is not built.

Agricultural lands would probably remain stressed due to the general shortage of water in the basin (see 6.2.1) and many other physical, economic and cultural factors (see 6.6.2). EPA funding (if any) of wastewater treatment improvements would be associated with improved water quality and a small reduction in the stress. EPA funding (if any) of an expanded plant would be associated with the retirement of up to 15.15 acres of irrigated land in order to provide additional water rights within TWSD (see 6.6.6).

6.6 SOCIO-ECONOMICS AND LAND USE

6.6.1. Existing Population, Land Use, Economy, and Infrastructure

County Population. Taos County's population declined through 1960 when the census reported a population of 15,934. Since then the population has grown slowly. Over the past 10 years, the county grew from 17,516 people in 1970 to 18,862 in 1980 (an average of 0.7 percent per year). Nearly half of the 1980 population lives in the immediate vicinity of Taos; major community concentrations are in Taos (3,369), Taos Pueblo and environs (2,112), and Questa (608). However, the county is still rural with most people living in numerous small villages located in the irrigated valleys along tributaries of the Rio Grande.

Continued slow, steady population growth is expected, to approximately 27,700 in the year 2000 (BBER, 1979). The Taos area will increase its share of the county population and, depending on activities at the MolyCorp mine, significant growth could also occur near Questa. Rural areas are expected to remain stable or, near Taos, grow somewhat.

Tourism adds substantially to the effective population of the region. While there is no actual count of tourists, annual visitation probably approaches a million visitor days, considering known skier visitation, estimates of summer use, and estimates based on tourism expenditures (Adams, 1981). More than 5,000 tourists per day visit the county during peak periods; this influx is most notable during the summer, but winter tourism, largely associated with skiing, has become significant in recent years.

Twining Population. Twining has a population structure which is typical of a resort: permanent residents are few, and there is a great fluctuation in the number of day vistors, overnight visitors, day employees and seasonal resident employees. For planning purposes it is the population during peak periods which is of greatest interest; in turn this is a function of the capacity of the area.

At present the effective skiing capacity is 4050 per day, since the lift-ticket limit is set at this level; however, TSV, Inc. plans to increase this to 4800 once the sewage plant is capable of handling this increase. The number of skiers is less than the capacity of the mountain, which is estimated to range between 5,846 and 8,122 skiers (Flance, 1980). Lodges and condos have a 'pillow' capacity of 931: 796 for guests and 135 for residents and employees. There are 295 pillows in the existing cabins (assuming 5 per unit). Thus, the current maximum overnight capacity of the area is 1226 persons (see Table 6-7 in section 6.6.3).

Actual populations in peak periods have approached the capacities noted above. The peak-day population to date is about 5,000, reached in the 1979-80 season. This figure includes 4,400 skiers, about 440 other visitors, and 335 employees; about 960 skiers and other visitors and 110 employees were overnight residents (Wilson, 1981). In comparison, the winter-long average population in 1979-80 was approximately 2,400 (or roughly 333,000 total employee, visitor and resident days). The peak summer population is about 330 (Wilson, 1981). Existing "baseline" population figures, presented in Table 6-7, are somewhat lower than past peaks due to the ski-ticket limit of 4,050 currently in effect.

County Land Use and Land Use Planning. Land uses in Taos County have changed little over the centuries. Rural uses predominate and are characterized by non-intensive agriculture and recreation/forest. Almost all the agricultural land is used for grazing; 40,000 acres (2.7 percent of the County) are irrigated (primarily for animal feed crops). Nearly all of the irrigated land (86 percent) depends on surface runoff and is located along the tributaries of the Rio Grande with concentrations in the Taos and Cerro-Red River areas and in the Embudo Drainage.

Twining's influence on regional land uses is concentrated in the area between El Prado and Amizette, where several commercial facilities (including condominium rental units) cater to skiers. There are also seven subdivisions on Highway 150 which owe their marketability at least somewhat to the proximity of the ski valley. The 356 lots in these subdivisions represent less than one percent of the platted lots in the county; build-out on these lots has been slow, but could increase if winter tourism continues to expand and overnight development does not occur in Twining. Future land use changes could also include some new commercial facilities along Highway 150, catering to the projected increase in skier use of the area. Refer to section 6.6 for a discussion of potential additional development pressures which could arise under the TWSD sewage treatment alternatives.

Two parts of the county face potential significant land use changes in the near future. One is the area in and near Taos, where urbanization is likely to continue, especially in strip development to the south of town. The second is to the north, from Questa to the state line. There, growth may occur in response to expansion of the MolyCorp mine and/or development of a new ski resort by the Rio Costilla Livestock Cattleman's Association. Also, the Public Service Company has proposed to trade the Top of the World Farms to BLM which might then develop a recreation area on a portion of the land.

The municipalities of Taos, Questa and Red River all have Comprehensive Land Use Plans. The county has taken preliminary steps toward development of a county-wide land use plan and zoning ordinance, but completion of the work appears to be some years away.

Land Use in Twining. A generalized map of land uses in TWSD is presented in Figure 6-6. The base area of the valley contains ski facilities of Taos Ski Valley, Inc. and several separately owned lodges and condominiums. East of the base area is a subdivision which contains more than 150 lots being developed mostly for cabins. Despite the area's growth, large amounts of vacant land occur within the base area and the subdivision; this land is owned by many different persons, most of whom do not live in Twining. There are also three large parcels of vacant land shown on Figure 6-6, owned by the Pattison Trust, the Burroughs family, and the Twining Association (an organization which includes existing Twining property owners and others).

Uses on Forest Service land outside TWSD include the parking areas, ski trails and the sewage treatment facilities, in addition to hiking trails and picnicking facilities unrelated to the ski basin.

The sewage treatment plant is located on a wooded, three-acre parcel for which TWSD has a special use permit from the Forest Service (see Table A-1 in Appendix A). The site is adjacent to and slightly below the level of Highway 150, approximately 850 feet from the nearest existing development (Figure 6-6). Although largely surrounded by undeveloped Forest Service land, there is a vacant, privately owned parcel on the opposite side of the Rio Hondo, southeast of the plant.

County Employment Patterns. Table 6-3 lists employment statistics for the period 1960-80. Several patterns are evident in the table.

1. The unemployment rate generally has been high, around 14 percent.

2. The number of jobs available has grown steadily over time, with the most rapid increase occurring in the 1970's.

3. At the same time the size of the work force has also been growing.

4. The unemployment rate decreased throughout the 1960's, as the number of jobs gradually increased, and the labor force expanded more slowly.

5. The unemployment rate increased in the 1970's, when the large number of new jobs was exceeded by the even larger number of people seeking employment.

All of these conclusions reflect long-term conditions; employment and unemployment often change substantially from year to year. Unemployment which is higher than both national and New Mexico averages remains a critical problem.

Although average unemployment has remained high, seasonal variations in unemployment have been reduced (Table 6-4). During the 1960's, summer and early fall unemployment rates were low, averaging 4 to 8 percent while winter unemployment rates often rose to 20 percent or more. The decreasing reliance on agriculture coupled with increased jobs in services, trade, government, manufacturing, and skiing have reduced this fluctuation.

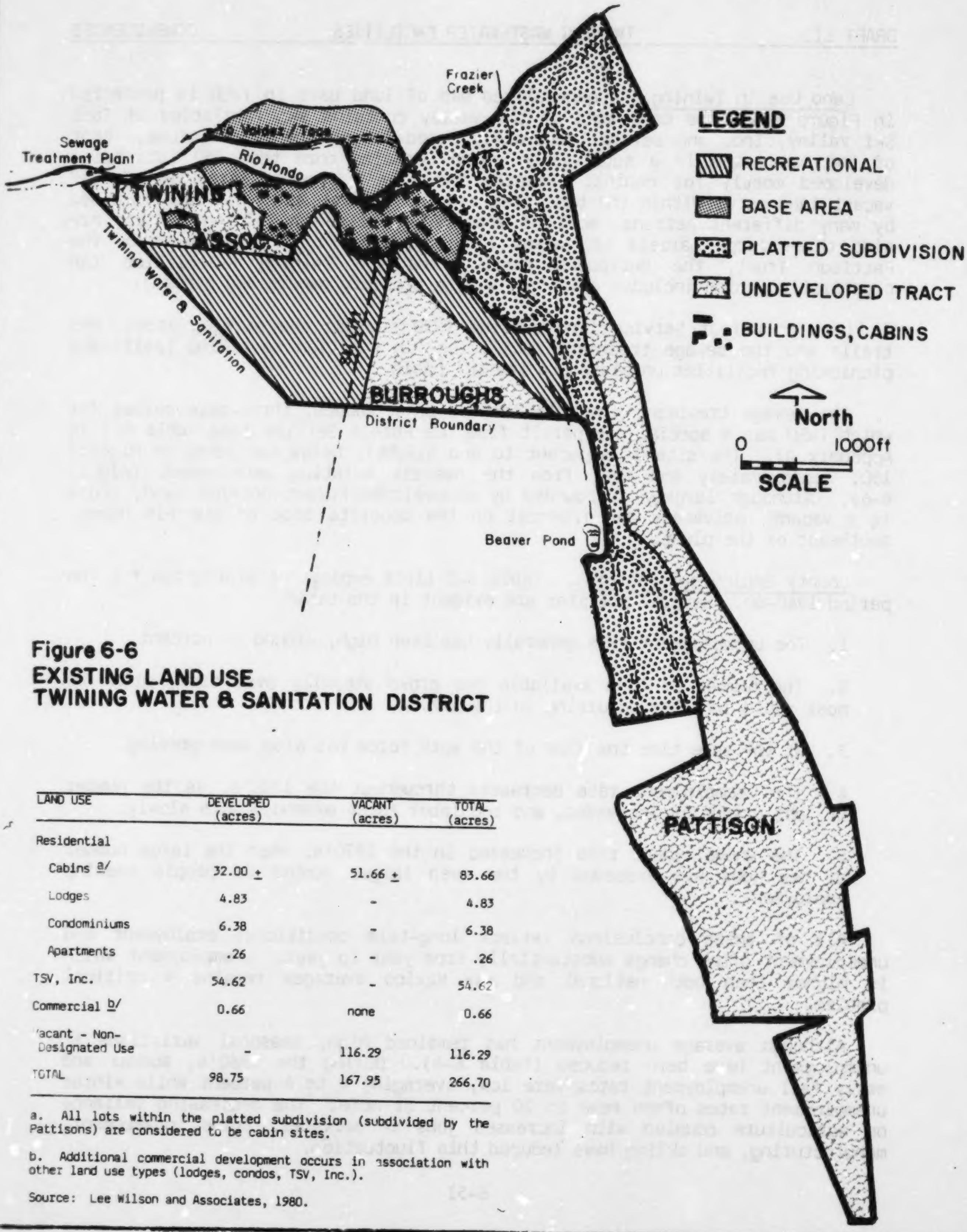


Figure 6-6
EXISTING LAND USE
TWINING WATER & SANITATION DISTRICT

LAND USE	DEVELOPED (acres)	VACANT (acres)	TOTAL (acres)
Residential			
Cabins a/	32.00 ±	51.66 ±	83.66
Lodges	4.83	-	4.83
Condominiums	6.38	-	6.38
Apartments	.26	-	.26
TSV, Inc.	54.62	-	54.62
Commercial b/	0.66	none	0.66
Vacant - Non-Designated Use	-	116.29	116.29
TOTAL	98.75	167.95	266.70

a. All lots within the platted subdivision (subdivided by the Pattisons) are considered to be cabin sites.

b. Additional commercial development occurs in association with other land use types (lodges, condos, TSV, Inc.).

Source: Lee Wilson and Associates, 1980.

TABLE 6-3. TAOS COUNTY EMPLOYMENT, 1960-1980.

YEAR	NUMBER OF PERSONS EMPLOYED	LABOR FORCE	AVERAGE ANNUAL UNEMPLOYMENT RATE
1960	3190	3884	17.8%
1961	3190	4089	21.8
1962	3370	4072	17.3
1963	3500	4099	14.6
1964	3915	4673	16.4
1965	4325	5078	13.6
1966	3840	4502	13.2
1967	4000	4498	10.9
1968	4190	4530	10.0
1969	4600	5003	8.0
1970	4720	5280	10.4
1971	4820	5727	14.4
1972	5165	6024	12.8
1973	5247	6022	12.9
1974	5765	6669	13.6
1975	6399	7750	17.4
1976	6876	8304	17.2
1977	7156	8666	16.4
1978	7726	8772	12.2
1979	7719	8799	12.3
1980	7640	8853	13.7

Source: New Mexico Employment Security Department data (figures based on place of residence)

TABLE 6-4. SEASONAL UNEMPLOYMENT RATE, TAOS COUNTY.

Month Yr:	1964	1965	1966	1967	1968	1976*	1977	1978	1979
Jan.	24.4%	19.9%	17.2%	16.4%	14.4%	15.0%	21.2%	16.6%	13.6%
Feb.	25.4	23.0	22.4	18.6	15.7	13.7	21.2	15.4	13.7
Mar.	23.6	24.3	21.4	16.1	13.8	13.6	19.5	12.9	14.1
Apr.	14.8	18.4	17.4	13.5	12.4	13.3	20.5	11.6	13.5
May	10.2	13.1	12.7	9.5	9.9	12.5	7.8	10.8	11.9
June	9.4	12.4	11.7	9.3	10.0	12.3	16.1	10.6	11.3
July	5.2	9.8	7.7	7.3	7.3	12.3	15.2	10.3	10.4
Aug.	4.9	7.9	7.1	6.9	6.2	10.9	15.7	11.5	9.9
Sept.	4.6	5.5	6.4	6.2	6.0	11.3	14.6	11.1	10.4
Oct.	5.9	5.9	7.8	6.6	6.1	12.0	13.6	13.6	11.0
Nov.	11.2	10.1	11.3	10.8	9.0	12.6	16.1	11.5	11.6
Dec.	16.6	12.9	13.5	11.5	8.6	18.2	15.2	11.1	11.0
Average	16.4	13.6	13.2	10.9	10.0	13.1*	16.4	12.2	12.3

Source: New Mexico Department of Employment Security.

*Note: Employment Security data for 1976 are conflicting. The average annual unemployment rates for 1976 do not agree in Tables 6-3 and 6-4.

Minority Employment. Hispanic and Indian people have had a higher than average unemployment rate in Taos County. For example, in 1970, 17 percent were without jobs, while the jobless rate for the remainder of the county residents was 8.1 percent. Employment Security Department (ESD) data reveal that in 1979 "minority" unemployment was 12.5 percent, while an 11.9 percent rate prevailed for the remainder of the population (Wilson, 1980). Thus the difference in joblessness between minorities and other groups has been substantially narrowed. The improvement in Hispanic employment is also shown by the increase in Spanish-surnamed members of the work force, from 2200 (41.6 percent of the total) in 1970 to 4400 (50.1 percent of the total) in 1978 (Wilson, 1980). However, in proportion to population, minorities are still underrepresented in the labor force.

Income. In Taos, incomes are low, although the situation is improving. Median family spending income in 1970 was about $4,500; by 1978 this figure had risen to $9,095 (SBP, 1979). Despite inflation there appears to have been a real increase in family income as incomes rose faster than the best available indices of the cost of living (national consumer price index and index of Albuquerque food prices). Incomes in Taos also improved relative to the state and nation. In 1970 the median family income was only 43 percent of the national figure and 51 percent of the state's average. By 1977 this had risen to 53 percent and 65 percent, respectively. Still the Taoseno's income is low and much improvement is needed. In 1970 (the most recent figure available), 35.8 percent of the families had incomes below poverty level ($3,745).

Agricultural Economy. Trends in Taos County's agriculture are similar to those of the nation. There has been a steady decline in agricultural production over the past 25 years and only large farms are proving to be economically viable. On the whole, agricultural pursuits in Taos County today are marginal and most farms are subsistence operations (Mimbres, 1978). Over the past decade the decline in the agricultural economy has slowed and it appears that this sector will stabilize. The remaining farms and ranches which do contribute to the county economy produced goods valued at $2,514,000 in 1979; total farm labor and proprietor's income was $2,819,000 (BEA, 1981). Agriculture also supplied summer employment for about 200 workers annually throughout the seventies (ESD, 1981).

Non-Agricultural Economy. Table 6-5 indicates the number of jobs associated with different sectors of the economy. Since 1970, jobs in the county have increased by 52 percent, faster than the state-wide increase of 42 percent. Most sectors of the non-agricultural economy have grown in proportion to the countywide increase. Services and trade are a major exception; these sectors have expanded more rapidly and now provide nearly half of the total employment. The growth in services and trade reflects both increased tourism and growth of the local and regional trade economy.

Similar trends are reflected in the personal income statistics by industry (Table 6-5). The economy is expanding; from 1970 to 1979 total non-farm income increased by 179 percent to $71,425,000. The decreasing reliance on mining and increasing role of trade and services is apparent, as is a small

TABLE 6-5. EMPLOYMENT AND PERSONAL INCOME BY SECTOR, TAOS COUNTY - 1970 AND 1979.

Sector	Persons Employed		Personal Income (thousands of dollars)	
	1970	1979	1970 b/	1979 c/
Manufacturing	181	414	720	5205
Mining	-	686	8674 d/	13532
Contract Construction	151	333	1107	3766
Transportation & Public Utilities	83	144	636	3394
Wholesale & Retail Trade	664	1,292	3678	12341
Finance, Insurance & Real Estate	108	195	635	2204
Services	1,354 a/	1,486	4340	14374
Government	938	1,526	6064	16300
Other Industries	-	-	-	309
Total	3,519	6,075	$25,581	$71,425

a. Includes mining employment, reported to be 789 (Yguado, 1972).
b. Based on 1967 SIC.
c. Based on 1972 SIC; preliminary figures.
d. Includes "Other Industries".

Source: Employment data from: Employment Security Department of New Mexico (figures based on place of work. Income data from: BEA-Personal Income by Major Sources, 1970-73 and 1974-79.

shift towards diversification with growth in construction, manufacturing and transportation, communication and utilities. Although the economic base is expanding, the economy is still dependent on tourism.

There is some potential to attract new non-polluting industries such as optical firms, science labs, and equipment assembly plants which specialize in high-technology products that have a high final sales price and small unit volume. Such industries may be willing to locate where transportation to markets is inefficient in order to have access to abundant, relatively low-cost labor and/or a preferred living environment. Generally, Taos is less competitive than other towns trying to attract these industries (Gonzales, 1981). Taos does have an abundant labor supply and it is a lower wage area; technical training programs could be established. However, New Mexico communities can offer companies few economic incentives (such as deferred taxes, etc.) since most revenues are collected by the State; community infrastructure frequently is inadequate; and most critically, in Taos, transportation and access to markets is poor.

Taos is an attractive area and if other problems can be overcome or are not critical factors to a particular firm, companies could select Taos for its attractiveness alone. If so, employment might improve without much adverse impact; however, there would not be much improvement in the current wage scale.

The Role of Tourism. Tourism is one of few 'basic' industries in Taos, (so labeled because it brings new money into the County and thus supports growth of the local economy). The important economic role of tourism is most evident in the jobs and income provided in the service and trade sector. Along with livestock and lumber products, tourism is considered to have the greatest capacity for stimulating local economic growth (NMSU, 1972).

Several studies have quantified the direct and indirect economic impacts of tourism. In 1979, the most direct effects in Taos County were as follows (CID, 1981).

Total travel expenditures 1979	$40,054,000
Travel generated payroll	$ 8,015,000
Travel generated employment	1,577
Local tax receipts	$ 390,000
State tax receipts	$ 1,859,000

These figures do not take into account sales of arts and crafts.

The major indirect effect is that, for every basic job, another 1.5 non-basic jobs (and possibly more) are created to serve the local needs of Taos County (Yguado, 1972). Thus, the 1577 jobs directly attributable to tourism (restaurant personnel, motel workers, tour bus drivers, ski instructors, etc.) probably account for another 2366 jobs (as for mechanics in local shops to work on tour buses, clerks to sell the mechanics tools, etc.) In total, nearly 4000 of county employment can be attributed to tourism, or about half the basic and half the total jobs. Jobs associated with arts and crafts are not included in this total.

The dollars spent by tourists also have a multiplier effect which is estimated to be about 80 cents for each initial dollar of expenditure (Adams, 1981). (This figure is lower than the job multiplier since much of the money received by proprietors and wage earners is spent outside of the County; Yguado, 1972). Combining this factor with the $40,054,000 spent directly by visitors in 1979, it appears that tourism contributed a total of about $72 million in expenditures, equal to more than 50 percent of total county gross receipts.

Formerly, tourism was largely confined to the summer months, but with growth of the ski industry, winter tourism has increased significantly and peak winter days now approach summer peaks (Armentrout, 1980). This change has been beneficial to tourist-oriented businesses, most of which are marginal and heavily impacted by the seasonality of tourism. Winter tourists also tend to be destination visitors who stay longer and spend more than summer visitors, thus contributing proportionally more to the economy (Mimbres, 1978; NMBJ, 1979). However, winter tourism is more vulnerable to the weather than summer visitation.

The Economic Influence of Taos Ski Valley. Based upon visitation and skier expenditure data, it is estimated that skiers at Taos Ski Valley contributed to about one-third of the total tourism impact in 1979, directly accounting for about $14,000,000 in expenditures and 335 jobs in the ski basin as well as 150 to 200 direct jobs in the region. USFS (1981a and 1981b) contains a more detailed analysis (with similar results) for the 1979-80 season; their analysis is summarized in Appendix D.1 of this EIS.

Twining Employment. About 335 people are employed in Twining during the winter, although this number varies depending on snow conditions. TSV, Inc. accounts for about two-thirds of these employees; the others are employed primarily in the lodges and condominiums and their associated restaurants. Jobs created within the resort complex tend to be filled by persons who are not long-time residents of the area. This is at least partly because of the presence of transients and newcomers who aggresively pursue the jobs, who have skiing skills, and who are willing to work in the evening hours. The skiing programs underway for area children will produce local residents trained in skiing skills, which may somewhat offset this trend.

The following characteristics are associated with most of the resort jobs held by Spanish-surnamed persons native to the area: they are service positions, with income and benefits comparable to service positions held by others; they are seldom of a supervisory nature; and they are limited to the winter seasons. Data on Twining employment are included in Appendix D.2.

Special Economic Issues. Several issues have been raised concerning the possible economic penalties associated with the income and jobs generated by the ski industry in Twining. (This is separate from issues of cultural impact, discussed in section 6.6.2). Three such issues were selected for study in this EIS: tax subsidies; property values; and buying power.

Appendix D.3 provides data which address the question of whether or not federal, state and local tax dollars subsidize the private enterprise which occurs in TWSD. The analysis suggests that skiers generate much more in tax revenues than they require from government expenditures and that there is no net subsidy of commercial activities in the District.

Appendix D.4 addresses the question of whether the presence of Taos Ski Valley affects land values in the surrounding area. Based on the price of residential properties (without water rights) in and near Taos County, the impact of the resort complex is prominent in the Twining-Amizette area where the effect on land costs is up to $45,000 per acre. A lesser impact occurs in the Valdez-Arroyo Seco vicinity, where land prices may be up to $2,000 per acre higher than in some other parts of the region, due at least in part to the presence of the Ski Valley. Assuming that the entire difference was due to the resort, the effect of Taos Ski Valley has been to increase land prices near the mouth of the Hondo canyon by about $200 per (non-irrigated) acre per year, which is perhaps 50 percent above the average. Further away there is no apparent direct impact of the resort. It is possible that the current pattern will change with time, particularly if pressure for development at the base of the mountain increases.

Appendix D.5 provides data which address the question of whether the shift toward a tourist economy has had an inflationary effect such that the local cost-of-living has risen faster than income. Based on approximate data, the analysis suggests that Taosenos have about the same comparative buying power as in other parts of Northern New Mexico. This does not necessarily mean that Taos natives have made real economic progress in recent decades, but rather that inflationary factors are typical of the region and not especially high because of local development such as TSV, Inc.

County Infrastructure. There are several types of infrastructure (services and facilities) which can sustain impacts from county growth in general and Twining growth in particular. These include highways, water and sewer systems, and energy and communications facilities.

Traffic to the resort uses Highway 150 between Taos and Twining. This road's capacity varies from 1242 vehicles/hour in the first five miles to 1800 vehicles/hour for the remainder. The average daily traffic ranges from a little over 2000 vehicles/day in the Arroyo Seco area to 600-700/day further up towards Twining: while hourly use varies, it is still well below the capacity of the road (Hayes, 1981). The road is in fair condition but is deficient from a safety standpoint due to such problems as narrow bridges and numerous sharp curves. In 1979, there was a total of 32 accidents on this road; the accident rate is particularly high near the sharp turn just past Arroyo Seco leading up to the Canyon. At this time, there are no plans for the road other than routine maintenance. Former plans to extend the road through to Red River have been canceled (Hayes, 1981).

The Town of Taos has community water and sewer service. The water system is adequate and can accommodate some growth. There are plans to expand this system to handle close to 10,000 people in Taos and its environs. The sewage system is presently overloaded. The community is preparing plans to expand this system; and facilities to serve about 8,000 people should be available in two years (Sayre, 1981).

Unincorporated communities nearby generally have a small 'mutual domestic' water system which is already at or near capacity and which would require expansion if growth occurs. For both the Town of Taos and the other communities, some water rights will probably need to be retired in order to allow expansion of the water system; however, Taos is expected to use its allocation of San Juan-Chama Project water for the bulk of its needs over the next 20 years. Several communities near Taos have formed or are considering formation of sanitation districts to develop sewage collection facilities (with independent treatment plants or hookup to the Town of Taos facility).

There are two power lines which serve Twining, one from Red River and one which comes up the Canyon. The Kit Carson Electric Cooperative does not anticipate any problems in providing power to serve future growth in the Hondo Canyon area. In addition to recent construction of new telephone cables, installation of a new substation is planned to solve current problems with service. Based on statements made by appropriate officials, the resort has no significant adverse effects (and in some cases has positive impacts) on such community institutions as the hospital, school system, and landfill (Wilson, 1981).

Twining's Infrastructure. As defined by the community, major infrastructure needs in Twining are for improved water and sewer systems and improvement of parking facilities for skiers. Some expansion of TSV, Inc. base facilities is also desired. Current problems and possible solutions for the sewer system are presented in chapters 3 and 5 of this EIS; the water system is discussed in section 6.2.4 and Appendix C.

A 30-year master plan has been developed for Taos Ski Valley, Inc. The improvements are intended to relieve traffic congestion and improve the quality of the skiing experience. They could also allow a longer ski season. The improvements will not fully develop the potential capacity of the ski area since the proposed skier limit is less than the capacity of the mountain. The schedule of improvements is based partly on the lack of an adequate sewage treatment plant. Facilities which would contribute wastewater to the plant would not be constructed until after the sewage problems of the area are resolved. Table 6-6 summarizes the improvements proposed by the master plan; the proposed actions and alternatives to it are evaluated in a separate EIS (USFS, 1981a and 1981b). The Forest Service has approved the master plan (with modification). The Forest Service decision has been appealed by members of the public on the basis that the Draft and Final EIS's were deficient; the decision has not yet been implemented. The appellants also requested a stay on implementation of the plan. The Regional Forester granted a stay on the up-mountain development but decided to proceed with the parking development for safety reasons. This decision has also been appealed by the public.

6.6.2 Cultural Patterns

The quality of life in Taos is strongly interwoven with its complex cultural history and traditional agrarian economy. Statistics do not adequately express the strength of area traditions, but they do demonstrate the dominance of a Spanish-Indian population. Table 6-3 indicates that about 66.5 percent of the county's population identifies itself as of Spanish heritage, and 6.6 percent are Indian.

These groups, along with a well-established artists colony (primarily Anglos who started arriving at the end of the last century), form a tricultural society in which each culture retains many of its traditions, not only during holidays, but on a daily basis. The Spanish and Indian social structure is based to a large degree on an economic system which derived from irrigated agriculture. That is, the culture of the region represents an adaptation to an agrarian environment. Despite the rapid decline of family farms in much of the U.S., small-scale, subsistence agriculture remains an important part of the human fabric in Taos, a fact which testifies to the value which Taosenos place on their rural way of life. Anglo immigration to the area is, at least in part, based upon the attractions of this lifestyle.

TABLE 6-6. SUMMARY OF TSV, INC. DEVELOPMENT PLAN.

The TSV, Inc. master plan has been revised to reflect the modifications resulting from the United States Forest Service EIS process. Their analysis addressed facilities involving Forest Service lands, i.e, up-mountain facilities and circulation and parking.

* = facility which could potentially discharge to sewage treatment plant

PHASE	TYPE OF IMPROVEMENT Up-Mountain	Base-Area	Circulation and Parking
Short-term (1-5 years)	Construct 2 lifts and trails Schwendi restaurant (private land) a/ Construct up-mountain restaurant Construct garage Construct ski patrol facility Expand east permit boundary b/	Relocate campground in conjunction with changes to parking lot Establish service station, information booths, ticket booths See also, circulation and parking	Expand permit boundary (by 21.9 acres) Revise road network, and expand parking lot capacity from 600 to 1,065 vehicles. There would be emergency parking for another 220 vehicles. Include bus/shuttle loading area, pedestrian walkways, passenger drop-off area, landscaping and drainage, signs, and traffic control measures.
Intermediate-term (5-10 years)	Construct 2 lifts Remove 1 lift Construct 2 trails Snowmaking expansion	*Relocate and expand day-skier facilities (on private land) *Construct mall, restaurant, and other visitor facilities (on private land)	
Long-term (10-30 years)	Construct 4 lifts c/	*Additional commercial, condominium, and second-home development on private land	

a. This was constructed in late fall 1980.
b. To bring existing El Funko trail into permit area.
c. These lifts were not explicitly approved by the USFS; will be reevaluated prior to development.

Agriculture is also of economic significance to some individual families who, by growing foodstuffs, reduce the pressures on limited cash resources.

Any decline in the viability of agriculture in Taos County has profound cultural implications and, for that reason, is almost certain to be resisted by a substantial portion of the population. Thus, there is widespread interest in the effects of wastewater management in Twining on irrigated agriculture. Water resources is one of the primary issues, since without water agriculture cannot survive. Another basic concern is the possible conflict between 'progress' (economic growth resulting from tourism) and the ability to sustain the traditional lifestyle.

As with any cultural phenomena, the subject is extremely complex and difficult to analyze. It is certain that there has been some damage to irrigated agriculture and cultural tradition in recent decades, and that some of these changes have occurred over the same time period as the growth of tourism in general and Taos Ski Valley in particular. It is equally clear that the very continuance of rural life is now uncertain, and that the deterioration of the water supply is a major part of the concern. What is not clear is the extent to which there is a cause-effect relationship between tourism, water supply and cultural change. That is, some causes and effects do exist between tourism and cultural change; but there are many other factors which also have an important influence on water and culture in Taos County. As one of the most visible factors, tourism receives much of the attention; but the other factors also must be considered in determining how those who wish to do so can best resist continued cultural change.

An analysis of the agrarian lifestyle, and the reasons for its ongoing alteration, was published in a recent Taos County report (see Chapter VII, by Diane Flock, in Wilson, 1980). The factors causing change can be grouped into three major categories, as discussed in the paragraphs which follow.

Physical Limitations to the Use of Land and Water. Taos is a marginal area for agriculture. The growing season is short and variable and summer precipitation is variable. Thus irrigation depends on naturally unpredictable surface runoff. Moreover, as described in section 6.2.2, there has been a countywide trend of reduced runoff, caused by tree growth in forest lands and by drought conditions. This decrease in surface-water supply has undoubtedly been a major factor limiting agricultural production and causing some Taosenos to abandon their family farms. In some areas, as the Rio Hondo watershed, water quality has also deteriorated and the stream is considered less suitable for irrigation.

The land itself is fragile. Soils are relatively poor in comparison with major agricultural areas. The availability of arable land is limited, most having been in production since the 1600's.

Increased Need for Land Resources, Decreasing Resources Available to the Individual Operator, and Inefficient Use of the Land. Over the centuries, continuing increases in the population of Taos County have placed pressure on the limited land and water resources. At the same time, factors related to the social and cultural history of the region's population have also contributed to the change in the agrarian lifestyle. These factors include decreasing productivity of the land, reduction of land and resources available to the family, and small-scale farming practices.

The decrease in land productivity reflects overuse as demand for production steadily increased to support larger populations and to meet rising expectations. By the early 1900's, depletion of the resource base was severe, especially on grazing lands.

Land holdings originally included family owned irrigated lands (generally a maximum of 40 acres) plus access to common lands for grazing, water, timber, and hunting. This amount of land is probably near the minimum needed to support a family. However, over time these holdings decreased to the point that, by 1939 the land available to the average family was only 6 acres (of which only about 4 acres could be cultivated due to land requirements for the house and other non-agricultural use). There are several causes of the change.

> Land potentially available for settlement to accommodate excess population was lost when New Mexico became a U.S. territory. During the same period, the use of common lands was restricted due to loss of title and/or overuse. Also, small operators found it difficult to compete with commercial users for access to federal grazing lands.
>
> The average size of the family plot steadily decreased because of the Spanish tradition of dividing the land equally among the heirs.
>
> For most families, land represents the only asset available to meet financial obligations and sale of the land is the principal means of raising needed cash. Land was sold originally to pay lawyer's fees in order to establish claim to the land in U.S. courts. Later it was lost for non-payment of taxes and other assessments (particularly during the Depression), and throughout it was sold to raise cash when other means were unavailable.
>
> Finally, in the urbanizing areas high land prices offer an incentive for the sale of land to those who want it for construction of homes and businesses. To a lesser extent, the potential income from the sale of water rights leads to sale of farmland. Increases in valuation because of prospective sale in itself can raise taxes on agricultural lands and speed the conversion process.

The current resource base may not allow the average family to survive solely on subsistence agriculture.

Small-scale farming practices hamper production on the small farms which dominate Taos County. Land inheritance patterns have resulted not only in smaller lots but also long, narrow lots (to maintain access to both road and stream frontage) and, for many, land is scattered throughout the area. Modern farming methods (i.e., machinery) cannot be used efficiently on such land. Also, almost all irrigated land is devoted to the support of cattle or sheep. While this pattern of use was undoubtedly prompted by the loss of common grazing lands, it does not use resources to produce the highest yield crops. Other factors which prevent the realization of the land's production potential include: the use of unlined irrigation ditches permitting seepage; little use of fertilizer; and limited use of techniques to prevent soil erosion. Often these conditions are in turn the result of the lack of capital to invest in improvements and due to the subsistence nature of most operations, it is frequently not realistic to make substantial investments.

Economic and Social Trends Affecting the Rural Way of Life. External factors also contribute to change in the subsistence agricultural lifestyle of Taos; the most important are the shift to a cash economy, involvement in the national agricultural economy, and exposure to social change.

The shift to a cash economy began from the first arrival of entrepreneurs from other areas, and evolved at an increasing rate through the latter half of the 19th century. Construction of the railroads in the 1870's permitted economic development on a scale unknown before and introduced a new, commercially-oriented economy with many wage jobs in commercial farming, ranching, mining, logging, construction (at a time when farms were already insufficient to meet the family's needs). For most, this meant working away from home part of the year, establishing a migratory work pattern which lasted until the depression.

Need for money steadily increased due to many factors:

- taxes and assessments to pay for improvements such as domestic water systems, range improvements, and roads;
- advancing technology, and exposure to other lifestyles created a demand for certain goods which came to be regarded as necessities, such as health care, electricity, refrigerators, washing machines, and automobiles;
- reduced production from the land (discussed earlier) required families to purchase what they once provided for themselves, including food, clothing, home building materials, and feed for animals.

These needs in combination with the others presented the family with an ever increasing need for cash.

Economic changes were not only local, but reflected shifts in the national agricultural economy. Specifically, modern farm markets are urban centers, which are most efficiently supplied by large, high-yielding mechanized farms located along major transportation corridors. Few farmers in Taos have been able to develop commercial enterprises to supply these markets. Further, subsistence operators lost local markets for their products when these markets switched to regional suppliers. In essence, in terms of the national economy, the Taosenos generally fit the category of the small operator who has been forced out of commercial agriculture. Today most subsistence farming in Taos provides food for the family and for some, extra income, but it is no longer the economic base of the area. However, in Taos, unlike other regions of the U.S., subsistence farming remains an important part of the social tradition, and this represents an activity which is essential to cultural survival.

Social change, evolving primarily from external factors, parallels, but lags behind, economic change. Increasing exposure to new values occurred both as people went to other areas to work and as newcomers came to Taos. World War II greatly increased this exposure. Many Taosenos left to serve in the armed forces and to work in defense factories in California. They were exposed to the nationwide development of new ideas, standards and lifestyles which were more urban, less rural and based largely on Anglo rather than traditional Spanish values.

Tourists are one of the factors contributing to increasing exposure to the outside world. The unique cultural mix and agrarian atmosphere of Taos (coupled with spectacular scenery) are primarily what draw tourists to the County. But these tourists also bring new ideas and new demands for what the area should provide and thereby themselves create pressures to change the area's character. It is not only the tourists who create change. Social change results from all exposure to other areas and this comes in the form of education (dominantly in English), travel, radio and television, and changes in religious practices, to name only a few of the sources introducing new alternative ideas and values, many of which are urban and threaten traditional values based on the land. In short, with modern communications and transportation systems, Taos is no longer isolated from national and global forces.

While tourists are not the only cause of change, they are highly visible. Local attitudes toward tourism vary depending on many factors. Based on public participation testimony, many Taosenos who directly benefit from the ski industry are supportive of tourism. This includes members of the business community as well as individuals whose jobs in the resort complex have helped them remain on their land. Often these individuals point out the very substantial employment and income benefits of tourism, the importance of free enterprise, and the ability of Taos to adapt to change.

Those who benefit less directly, or not at all, tend to be less supportive or are opposed to expansion of this segment of the economy. Their objections reflect numerous areas of conflict which create friction:

- tourists are personal representatives of the modern, urban values which are encroaching upon the traditional society; natives who want to retain the old values resent this invasion;

- tourists, skiers in particular, are generally more affluent than the local population;

- community members who directly benefit from tourism are also often more affluent than the local population and include a high proportion of non-natives;

- tourists are using land for recreation that the natives want to use to maintain their traditional livelihood;

- residents feel that the activity and development in Twining disturbs the natural harmony of the mountains, and further that this adversely affects the supply and quality of the water used to support downstream farms;

- the jobs provided by tourism tend to be low-skilled and low-paying and are often viewed as having a low 'value', contributing little to a person's self-esteem;

- the industry is seen as obtaining special benefits from government, as for example public funding of the TWSD facilities plan and EIS; many feel such funds should be spent on programs oriented more toward the needs of the native population.

It is difficult to synthesize these attitudes into a single phrase, but perhaps the notion of 'adding insult to injury' characterizes the position of many persons who do not favor a tourist-oriented economy (and especially skiing). The injury is viewed as including adverse impacts on land and water resources and traditional values; the insult includes the use of public funds to further this development and the concept that the wealth so produced, which natives are told is the reason for such support, comes to them visibly through service jobs waiting on tourists. The preference is for alternative types of growth and development which are compatible with the established culture and which do not require such an adaptation to a new way of life where the traditional lifestyle is lost.

Thus, resistance to resort expansion represents, at least in part, the perception that tourists are a threat to the continued existence of the traditional lifestyle and that the newly evolving economic and social system offers the native no advantage, nor even an equal share. However, as noted earlier in this section the cause-effect relationships influencing the local culture are complex. It is not clear if all those who oppose increased tourism understand that this position attacks only a part of the problem. Taos, like countless rural areas elsewhere, is changing for many reasons; it is doubtful that the established culture can be sustained unchanged even if everyone so desired. Indeed, much of rural northern New Mexico does not have the tourist invasion experienced by Taos, yet experiences many of the same problems in maintaining an agricultural tradition.

The complexity of cultural phenomena, and the inevitability of change, are not reasons to ignore impacts which may result from such actions as a new treatment plant in Twining. Rather, effective, long-term solutions to social and economic problems require effective, long-term management of as many of the controlling factors as practical. While social and economic considerations must play an important role in TWSD's facilities planning and EPA's decisions about facility funding, these cannot substitute for comprehensive planning and locally based decision-making about such factors as the role tourism should play in the economy and the means by which agricultural land and water may best be protected.

Summary. Changes in the traditional agrarian lifestyle in Taos County have been ongoing for many decades and are caused by many factors, including (in order of presentation here, and not necessarily in order of importance): natural limitations of soil and water supply; changes in water quality; a recent trend toward reduced runoff; past overgrazing; the loss of land grants; the high cost of using federal lands; decreases in the size of irrigated parcels; the fact that land is among the few assets which can be sold to raise cash; loss of land for non-payment of taxes and other assessments; the high value of land in urbanizing areas; the value of water rights; small-scale farming practices; the lack of capital to invest in farm improvements; the development of a commercially oriented economy (especially since construction of the railroads); the rising importance of cash, wages and emigration in response to this economic change; the increased need for money to pay for community improvements and newly defined necessities of life (e.g. health care, electricity, appliances, automobiles); the need to purchase food, clothing and other products formerly produced on the farm; the national trend toward food markets which are supplied by large, mechanized farms; and increasing exposure to outside values (especially since the beginning of World War II).

It seems evident that these factors, which have arisen from many causes, have substantially reduced the ability of Taosenos to derive a livelihood from the land and therefore have had a significant, adverse impact on the agrarian lifestyle and cultural tradition of Taos. The surprise is that subsistence agriculture continues to play such an important role in the community. Although Taosenos derive some economic benefit from farming, the economic importance of irrigation appears to be secondary to its role as the cultural foundation of the community.

Because there are so many factors which have influenced cultural change in Taos County over a very long period, because there are few data describing socio-economic trends over the past centuries, and because of limitations in study methods, the state-of-the-art in socio-economic analysis does not permit quantification of the magnitude of change associated with the development of Taos Ski Valley.

For example, to truly assess the effects of Twining on farming one would have to resolve long-standing debates about the importance of land grant losses (and lot splits, etc.), then separate out the water-resource effects of retiring 10 acres of land versus climate and watershed changes which have reduced runoff by several thousand acre-feet, then try to determine whether people who emigrated before the ski valley did so for reasons different from those who emigrated in the 60's or 70's (assuming these people could be found), and so on. The analysis would have to derive sufficiently precise correlations to enable firm predictions about future change should the resort develop further; and to be of value to EPA, the predictions would have to be sufficiently sensitive to distinguish between the effects of capacity alternatives which, in reality, do not lead to markedly different future conditions. A comprehensive study of these issues is beyond the scope of a facilities plan and EIS; even for a countywide plan, only a few of these factors could be assessed adequately.

Based on a more generalized analysis, and considerable public input during the planning process, it is very likely that tourism is responsible for at least a portion of the following factors: changes in water resources, high values on (and incentives to sell) agricultural land in prime growth areas and land with water rights, the value of water rights, the development of a commercially oriented economy, non-agricultural use of public lands, and increasing exposure to outside values. The economic benefits of tourism are very substantial but not equally shared nor always desired. Wastewater management decisions must reflect these factors, but a comprehensive resolution of the cultural issues which face the community is not possible within this EIS and can be accomplished only by the people of Taos through the political process, for example, through preparation and adoption of a comprehensive plan.

6.6.3 Development Potential and Population Projections for Twining

The development potential and projected population in Twining will determine the future sewage flows which must be managed and will identify the magnitude of potential growth impacts. Normally population projections for sewage-treatment plants are established by the state as part of their statewide planning process. Such projections are intended to reflect established trends in development, and often show a 50-100 percent increase in growth over a 20-year period. However, for Twining the state projection was that the peak-day population in the year 2000 would be 4000 persons, a number which has already been exceeded. Therefore, a more accurate population projection was developed for use in evaluating alternatives (Wilson, 1981).

Forecasts of the growth in resort areas is always difficult because such areas are very sensitive to external economic factors. Twining poses a special problem because there is no formal master plan for development in TWSD, nor are there zoning regulations or other laws to control land use (except within the Pattison subdivision). The only basis for projections is to consider what has happened in the past, and what people say or believe may happen in the future. Thus, the approach used in this report involved the assessment of many factors which could influence the growth potential of the area, such as past trends, existing conditions, and known development plans. The implications of these factors were discussed with persons familiar with TWSD (including District members and realtors), and a range of projections was established reflecting alternative development scenarios. This section reviews the development potential of Twining and presents the resulting population projections.

Past Rate of Growth. Development of the ski area began in the mid-fifties. Most existing facilities were built during the sixties, but growth continued through the early seventies. Although only one new lodge was built in the early seventies, this coupled with expansion of other facilities, increased overnight capacity of lodges and condominiums from 411 in 1970 to 931 in 1979, a 127 percent increase. (The figure of 931 includes both live-in residents and overnight guests.) While cabin growth has occurred more slowly, a total of 59 cabins have been built over the last 15 years or so; this is a rate of four per year. During the past few years cabin development has been somewhat erratic but it does not appear that current economic conditions have slowed the rate of cabin construction (Bryan, 1980).

High-density development, however, has been restricted in recent years by the lack of sewage treatment capacity at the TWSD plant and the moratorium on sewer hookups which has resulted. A few exceptions to the moratorium have been approved (for example, to permit a new bathroom during remodeling). Also, some expansion has occurred by adding rooms without increasing the number of sewage connections. Despite this activity, the moratorium has definitely limited high-density development, as well as expansion of TSV, Inc. base facilities.

Expansion Potential. A map and description of current land use in the District is presented in section 6.6.1. Lots within the Pattison subdivision have specific land-use restrictions (e.g. commercial, residential) but otherwise there are no legal controls on land use in TWSD. Consequently, there are no effective development or density restrictions other than those imposed by the terrain or by wastewater treatment capacity. These restrictions are discussed below.

Within TWSD there are three large undeveloped properties, totaling over 100 acres, which could accommodate a significant amount of growth (Figure 6-6). One of these large holdings is tract H owned by the Pattisons. The southern portion of the tract is the land for which the Kachina Village plan was proposed, which would have housed more than 2,500 people. This land is available for development. However, the fact that the entire wasteload allocation is held by Twining, and that it does not allow for substantial growth in the short-term, indicates that a project the magnitude of Kachina Village would not be built in the near future (unless an independent, total recycling treatement plant were used). However, this type of development, or at least some use of the Pattison tract, remains a realistic potential in perhaps 15 or 20 years.

The other two large holdings, 33 acres owned by the Burroughs and 18 acres owned by the Twining Association, have potential for development of overnight accommodations and/or commercial ski-related facilities. At this time, the Burroughs have indicated an interest in retaining their land in its present state. The Twining Association land, however, has been discussed as the potential site of a condominium development or, possibly, additional skiing facilities.

In addition to these three large vacant tracts there are also 94 cabin sites which are as yet undeveloped. All but 15 of these have been purchased and, so far at least, people have bought with the intention of eventually building rather than for speculation so it is likely that they will be developed during the planning period (Bryan, 1980; Kleiner, 1980). Further, most existing developments could be expanded to accommodate growth.

Capacity for Development. From an engineering viewpoint, virtually all land within TWSD is potentially developable. Rocky and marshy soils place some constraints on construction, particularly for septic tank systems, but do not prohibit development if specialized wastewater systems are used. The most severe constraint on construction is steep slopes. Still most of TWSD has slopes of less than 40 percent. Such areas are considered buildable, if access is feasible. There is some developable land outside TWSD. This land includes parts of the National Forest and parts of the remaining holdings of the Pattison Trust. Except along the river valley extending to Bull-of-the-Woods Pasture, access to this land would be a major obstacle to development.

While estimates vary, previous studies indicate that the 267 acres within TWSD could accommodate between 4,000 and 4,500 overnight residents if fully developed (Taos Architects, 1970; Beardsley-Davis, 1973). If such development were at current high densities (10 units/acre +), not all of the buildable, accessible land in the area would be utilized. Therefore, at least theoretically, an even greater number of persons could locate in the area. In summary, the availability of buildable land is not a severe limitation to development of additional resort facilities in the Twining area. However, access may affect the economics of development, such that not all the land would be put into a high-density use.

The effect of restricting sewage treatment capacity on development is uncertain. As noted previously, it is physically possible to construct some type of on-site wastewater system on most (if not all) land in TWSD. Although this poses an economic barrier to development, it is one which may be overcome considering the commercial nature of the area and the high value of land. TWSD would have authority over on-site systems. As long as there is insufficent plant capacity to accommodate new growth, TWSD would not prohibit on-site systems in the District. However, regulations could limit the types of on-site systems used, with preference given to alternatives which do not involve conventional septic tank drainfields. Theoretically, the limit on total pollutants which may be discharged from area sewage systems would ultimately prohibit any future development, except for construction incorporating total recycling systems.

Plans for Development. TSV, Incorporated. The ski corporation has the announced intention of limiting lift-ticket sales to 4800 per day. In all the discussions presented in this report, it is assumed that the Ski Valley will be successful in accomplishing its stated objective. It is by no means assured that this limitation can be imposed due to legal, management or other constraints. If the limitation is not successful then day populations would be much higher than indicated in this report. Since the ski limit is only 10 percent greater than the peak day in 1979-80, it could probably be reached in the next good ski season. However, until sewage treatment problems are resolved, there is an interim limit of 4,050 skiers per day. TSV, Inc. has also indicated interest in expanding base facilities, including some restaurants (section 6.6.1).

Lodges and Condominiums. Current development proposals by TWSD landowners include the expansion of existing facilities, as well as the construction of new condominiums and lodges. In general, these proposals represent openly-discussed intentions, rather than formal plans and specifications.

Interviews with TWSD residents indicate that if a resolution of the sewage problem so permitted, much of the proposed development would occur within 1-5 years. At a minimum, by 1985 new construction could include the expansion of existing facilities and two condominiums which are currently in the planning stage. This would add 1,169 pillows to overnight capacity, a 125 percent increase.

Beyond the development discussed above, there is talk concerning four sites on which additional condominiums/lodges might be built. Also, some lodges have indicated an interest in long-term expansion. In both cases, there are few specifics in the discussions. Based on interviews with local residents, such development would probably occur in the period 1985-1990, if not by 1985, and could involve more than 680 new pillows. Coupled with the development discussed previously, the total increase in overnight capacity would be more than 1,849 pillows, which would represent a growth of at least 200 percent over current conditions.

Cabins. Interviews with TWSD residents indicate that there are no factors which would markedly change the historic pattern of slow, steady cabin development. There are 94 lots in the cabin subdivision which remain vacant; 79 of these have been sold. At historic rates, four cabins would be built per year, so that all the sold lots would be occupied by the year 2000.

Development Beyond Announced Plans. It is not certain that all of the proposed development would occur even if there were no water-quality problems in the area. For example, setting a limit of 4800 skiers might reduce interest in the development of overnight accommodations. (Or, it could slow condo growth unless and until the area were to become a summer as well as a winter resort.) Still more uncertain is whether or not development could go beyond announced plans. Some large ski resorts have more overnight capacity than lift tickets; for Twining, it is at least theoretically possible to foresee an overnight capacity equal to daytime capacity. This equates to a demand for perhaps 5,000 pillows, a level which is within the physical capacity of the land, and a level which could result from a project the magnitude of Kachina Village. The purpose of this observation is simply to point out that even the high projection given in this report does not reach the level of growth which is possible in the area.

Projected Growth in Twining. The review of past development and future plans in the Twining Water and Sanitation District (TWSD) provides a range of predictions about the number of residents and visitors who could contribute to wastewater flows in the year 2000; see Table 6-7. The actual numbers will depend on the development policies adopted by the community or, if no policies are adopted, on economic conditions. The projections concentrate on peak winter conditions which represent the maximum flows which must be handled over a prolonged period.

Five growth scenarios are presented. Based on alternative growth policies, four predictions were developed: the lowest estimate, representing no increase in the current skier limit and no high-density growth; a low estimate, representing an increase in the skier limit but no high-density growth; a high estimate, representing TWSD's desired level of growth; and the highest estimate, representing the magnitude of growth which could occur from construction of all proposed new lodges and condos (excluding Kachina Village). In addition, populations associated with a 95,000 gpd plant have been developed and included in the analysis, since this size plant has been identified as the maximum which can be built and still protect stream standards. This projection allows a moderate amount of growth, representing an increase in the skier limit and some high density growth. Table 6-7 includes the assumptions used to develop the projections and presents the actual numbers for each component of the population (i.e., employees, skiers, and guests). Although the high projection is the maximum contained in this report, higher populations (particularly at night) would occur if every acre of developable land in TWSD were fully utilized for overnight facilities. With full development, overnight populations could exceed 5,000 people.

Projected Sewage Flow. Design flows for the sewage treatment plant have been developed for each population projection and for existing conditions. These figures and their derivation are presented in detail in Table 6-7. A major difference in the projections relates to assumptions as to which portions of the population would be served by the central wastewater system versus those that would be served by on-site systems. The existing central system serves five (of 59) cabins, and all base facilities except for one condominium. Five additional cabins have temporary on-site facilities and desire hookups. For the low population projection it is assumed that the condominium and these five additional cabins would be hooked up to the central sewer system. The remaining 44 existing cabins, and all of the projected 94 new cabins are assumed to use on-site systems. For the intermediate and high projections, all high-density development (lodges, condos) are assumed to be served by the treatment system. The intermediate projection also assumes that ten cabins (5 now on the system and the 5 additional units discussed above) would be hooked up, while all other cabins are assumed to use on-site systems. The high projection assumes all cabins (and therefore all development) would be served by the central system. This projection illustrates the capacity required to serve all growth discussed in this EIS (except Kachina Village).

TABLE 6-7. YEAR 2000 PEAK-DAY POPULATIONS AND SEWAGE FLOWS.

FACTOR	EXISTING	LOWEST PROJECTION	LOW PROJECTION	MODERATE PROJECTION	HIGHER PROJECTION	HIGHEST PROJECTION
CONCEPT	1981 conditions	No high-density growth continued cabin development; skier limit = 4050/day	No high-density growth; continued cabin development; skier limit = 4800/day	High-density growth of 489 pillows as permitted by plant capacity; skier limit = 4800/day	Desired growth: double existing lodge and condo capacity; continued cabin development; skier limit = 4800/day	All proposed lodge and condo development; continued cabin development; skier limit = 4800/day
PEAK-DAY POPULATION						
Lodges a/						
Existing Pillows	384	384	384	384	384	384
Expansion	-	0	0	79	79	79
New Lodge	-	0	0	0	0	200
Condominiums b/						
Existing Pillows	547	547	547	547	547	547
Expansion	-	0	0	164	164	164
New Lodge	-	0	0	246	688	1,406
Cabins c/						
Existing Pillows	295	295	295	295	295	295
New	-	470	470	470	470	470
Total Pillows						
Existing Pillows	1,226	1,226	1,226	1,226	1,226	1,226
New	-	470	470	959	1,401	2,319
TOTAL	1,226	1,696	1,696	2,185	2,627	3,545
Timing of Development d/	Existing; No additional cabins	See note c	See note c	1980-85; plus see note c	1980-85; plus see note c	1980-1990; plus see note c
Employees e/						
Total	333	333	354	409	459	560
Overnight	135	135	135	135	138	168
Day Only	198	198	219	274	321	392
Skiers f/						
Total	4,050	4,050	4,800	4,800	4,800	4,800
Overnight	1,049	1,495	1,495	1,964	2,381	3,233
Day Only	3,001	2,555	3,305	2,836	2,419	1,567
Non-skiers f/						
Total	342	322	396	370	350	301
Overnight	42	66	66	86	108	144
Day Only	300	256	330	284	242	157
Peak Day Population						
Total	4,725	4705	5,550	5,579	5,609	5,661
Overnight	1,226	1696	1,696	2,185	2,627	3,545
Day	3,499	3009	3,854	3,394	2,982	2,116

TABLE 6-7. (continued).

FACTOR	EXISTING	LOWEST PROJECTION	LOW PROJECTION	MODERATE PROJECTION	HIGHER PROJECTION	HIGHEST PROJECTION
CONCEPT	1981 conditions	No high-density growth continued cabin development; skier limit = 4050/day	No high-density growth; continued cabin development; skier limit = 4800/day	High-density growth of 489 pillows as permitted by plant capacity; skier limit = 4800/day	Desired growth: double existing lodge and condo capacity; continued cabin development; skier limit = 4800/day	All proposed lodge and condo development; continued cabin development; skier limit = 4800/day
SEWAGE FLOW						
Hookups g/	Existing; only 5 cabins; Kandahar not on system	All high-density development; 10 cabins	All high-density development; 10 cabins	All high-density development; 10 cabins	All high-density development; 10 cabins	All development incl. all cabins
Overnight Population on System x 50 gpcd g/	788 pillows = 39,400 gpd	981 pillows = 49,050 gpd	981 pillows = 49,050 gpd	1470 pillows = 73,500 gpd	1912 pillows = 95,600 gpd	3545 pillows = 177,250 gpd g/
Day Population on System x 10 gpcd h/	39,130 gpd	36,860 gpd	47,320 gpd	40,735 gpd	36,610 gpd	21,160 gpd
Peak-Day Flow from Hookups	78,530 gpd	85,910 gpd	96,370 gpd	114,235 gpd	132,210 gpd	198,410 gpd
Average Daily Flow Peak Week i/	69,892 gpd	76,460 gpd	85,769 gpd	101,665 gpd	117,667 gpd	176,585 gpd
Infiltration j/	1,600 gpd	1,600 gpd	1,600 gpd	1,600 gpd	1,600 gpd	1,600 gpd
Design Flow k/	71,492 gpd	78,060 gpd	87,369 gpd	103,265 gpd	119,267 gpd	178,185 gpd
Sewage Discharged to On-site Systems l/	15,806 gpd	25,775 gpd	25,775 gpd	25,775 gpd	25,775 gpd	0 gpd
Design Flow with Water Conservation m/	71,492 gpd	78,060 gpd	84,630 gpd	95,125 gpd	105,690 gpd	147,830 gpd
Sewage Discharged to On-site Systems with Water Conservation m/	15,810 gpd	20,175 gpd	20,175 gpd	20,175 gpd	20,175 gpd	0 gpd

TABLE 6-7. (continued).

Footnotes

a. Existing lodge capacity based on survey described in report on Twining Water System; expansion estimates based on interviews with lodge owners, described in same report; estimate of new pillows made by Chris Stagg assuming construction of TSV, Inc., Hotel.

b. Condos include apartments. Existing condo capacity based on survey described in report on Twining Water System; expansion estimates based on interviews with condo owners, described in same report; estimate of new pillows made by Chris Stagg assuming completion of known development plans and a maximum capacity of 3-4 people/room. Intermediate projection simply reflects construction consistent with a doubling of overall lodge and condo capacity. High projection based on: 800 pillows in condo near Sierra Del Sol (request for 200 hookups already on file); 126 pillows in condo near Thunderbird; 120 pillows in condo near Edelweiss; 160 pillows in TSV, Inc. condo near garage; 200 pillows in condo near Rio Hondo.

c. Cabin capacity assumed to be 5 pillows. Existing based on actual cabins now built (59 cabins); projection assumes development of all vacant lots at build-out rate of 4.7 cabins/year (total 94 cabins).

d. Based on discussions with TWSD residents, TSV, Inc. officials, etc.

e. Existing situation based on existing employee count as reported in study of Twining Water System. For other projections the number of employees is calculated to increase in proportion to the increase in skiers and overnight guests. Of these employees, 30% are assumed to stay overnight; the rest are day employees.

f. Calculations related to skiers and non-skiers are interdependent. First 5% of total condo and cabin capacity (not lodges) were assumed to be overnight non-skiers; this is based on discussions with TWSD residents. Those pillows not allocated to non-skiers and employees are assumed to be used by skiers. Skiers not staying overnight are assumed to be day skiers. Non-skiing day visitors are assumed to be 10% of day skiers based on traffic surveys at the ski valley.

g. Existing hookups include 5 cabins and all high-density development, except the Kandahar; low projection hookups assume Kandahar is added to system, plus 5 existing cabins now using holding tanks. Remaining cabins assumed not hooked up. Similar assumptions apply to intermediate projection; however in the high projection all cabins are assumed connected to system. Flows (gallons per capita per day, gpcd) based on earlier study of Twining Water System.

h. Day population on system is the difference between total day population and overnight population on the system, except that non-skiers who occupy cabins/rooms not hooked up to the system are assumed not to contribute to system flows. The existing flows also exclude 8 day employees at the Kandahar.

i. Assumes week-long flows average 89% of weekend peak.

j. Existing assumes current infiltration of 25,000 gpd is reduced. Infiltration figure based on standard EPA factor.

k. Average daily flow in peak week, plus infiltration.

l. Flow from rooms/cabins not hooked up to system; excludes day contribution of skiers who occupy rooms/cabins; assumes week-long flows average 89 percent of peak day.

m. Assumes use of dry (eg. composting) rather than conventional toilets in new construction; this will reduce flows from new units by one-third.

Another variable assumption relates to the effect of adopting additional water conservation measures. Table 6-7 includes calculations without such conservation, as well as flows which would result from a requirement to use dry or extremely low-flush toilets in all new construction.

A final major assumption involves the relationship of peak-week populations (the basis for treatment plant design) to peak-day populations (the numbers just calculated). This relationship is known as the loading factor; presently it is about 70 percent for the ski season as a whole. Past trends are toward an increase in the loading factor, especially in peak periods. The limit on lift-ticket sales will reinforce this trend. Based on discussions with TWSD residents and others, a loading factor of 89 percent has been used in Table 6-7. This means that for the entire peak week, populations would average 89 percent of the weekend maximum.

The estimates of sewage flows are intended to indicate the amount of wastewater which could be generated in Twining during prolonged peak periods. They do not imply that a single, central plant must be built to accommodate a particular peak flow. Rather, the adopted alternatives must account for management of the flows which are associated with the adopted development projection.

6.6.4 Impacts of the No Action Alternative

The no-action alternative would avoid any socio-economic and land use change resulting directly from treatment plant actions, but not necessarily avoid considerable change resulting from development in TWSD. Such development would reflect increased use of the area in non-peak periods (early and late in ski season, summer) plus cabin development and other relatively small-scale growth using independent on-site wastewater systems. The nature of this development is discussed in section 6.6.6 in the context of the 'existing flow' alternative of an 80,000 gpd treatment facility. Also, continued pollution of the Rio Hondo would interfere with the water resource needed by summer residents.

6.6.5 Impacts of Treatment Alternatives

The major economic, cultural and land-use impacts of treatment alternatives were discussed in section 5.2. By way of summary, these effects include the following.

- Direct economic costs to TWSD (and funding agencies) vary according to the alternative being considered. None of the most expensive options are likely to be the most cost-effective and there are still substantial cost differences between the remaining alternatives. The most expensive of the conventional alternatives is also considered the most reliable, flexible and capable of expansion; it could produce the best quality effluent on a day-in, day-out basis. Aquaculture (alternative 2) is potentially one of the least expensive options, but its reliability has not been proven and could increase the risk of failure. The final decision must reflect whether the additional reliability (which cannot easily be quantified) and effluent quality are worth the additional expense ($35,000 to $40,000 per year more if alternative 1 is selected over alternative 12).

- Many of the alternatives were found to have major water-supply impacts (for example, regional options generally increase water-rights requirements for TWSD) and/or water-quality impacts (on-site systems and snowmaking probably would violate the stream standards). In turn, these impacts would have an adverse effect on downstream residents and their agrarian lifestyle. The alternatives with the greatest adverse impacts would not be considered most cost-effective.

- Some of the regional alternatives would provide potential benefits to the regional community, but also have the potential for creating or increasing community conflicts. Severe land use problems could also result from the two options which would create a regional sewer system (alternatives 10 and 11; see section 5.2). These impacts are a major reason for concluding that the regional choices are not acceptable.

Regarding the type of treatment process (as opposed to the size of a plant), the major issue which has not been resolved in the planning process is whether or not the costs of alternative 1 (in relation to the other two alternatives) are justified by its additional reliability and flexibility.

6.6.6 Impacts of Capacity Alternatives

The relationship between treatment plant capacity in Twining and the economy and social structure of the Taos region are quite complex, often subtle, and difficult to analyze (see discussions in sections 6.6.1 and 6.6.2). In this EIS the emphasis has been on identifying the major changes which definitely relate to expansion of the resort complex - that is, those impacts where a cause-effect relationship can be readily assessed. With these impacts in mind, it is possible to discuss in a general way those changes which are more speculative, such as cultural changes which have multiple causes and which may depend somewhat on the differing perceptions of different members of the community.

There are five primary categories of change which can be projected to occur in Twining and which will be discussed in the pages which follow.

1. Economic benefits are likely to expand simply due to increased use of the area in off-peak periods during the ski season. This expansion can occur with or without an enlarged sewage treatment plant and relates to a more continuous, intensive use of the area, rather than an increase in peak use.

2. Increased summer use of the resort complex would have the same effect as increased skier use in off-peak periods and also would result in more

continuous, intensive use of the area. At present there is no indication that summer use will increase dramatically, but it could do so with or without an enlarged sewage treatment plant.

3. There is certain to be some physical expansion of the resort due to developments which use on-site systems (OSS) and which are therefore independent of the capacity of a central treatment plant. This expansion could include cabin construction on most and probably all of the 94 vacant lots in the Pattison subdivision; also, at least some lodge and condo development could occur in the base area and TSV, Inc. could probably use OSS to service an increase in the skier limit.

4. If permitted by expansion of the TWSD treatment plant, there would be an increase in skier capacity from 4050 to 4800 per day. This would represent real growth of the area which would be supported by selection of a capacity alternative.

5. The size of the sewage treatment plant can influence the location of new overnight facilities. If an intermediate capacity is chosen (such as alternative C), which services new skiers but supports no lodge expansion in TWSD, then there could be an increase in demand for overnight capacity which must be met somewhere else in the Taos region (or in Twining using on-site systems). The effect of expanding the TWSD plant to 95,000 gpd, rather than an intermediate limit of 85,000 gpd, is to facilitate the development of overnight capacity in Twining. In the discussions which follow, 'elsewhere' is referred to as the Taos Region (or simply the region); it includes areas such as Amizette, Valdez, and Arroyo Seco as well as Taos and, for some impacts, may extend to Red River, Angel Fire, and Santa Fe.

To help highlight these five types of change it is useful to first consider the impacts associated with items 1 and 4 - changes which relate directly to the size of the ski industry. Then it is appropriate to discuss the impacts of items 3 and 5 - which deal more with the character and location of resort development rather than the total size of the ski industry. There is little basis on which to assess possible impacts from summer tourism (item 2). The assumption is that Twining will not become a major yearround resort; calculations of impacts (adverse effects only) assume that summer visits average 10 percent of winter visits. Finally, it is possible to discuss some of the secondary or indirect effects of all five types of change. As appropriate, other sections of this EIS deal with the physical consequences of growth, such as changes in stream flow, water quality, air quality, etc.

Direct Impacts of Ski Industry Growth. Table 6-8 summarizes the major, direct effects on population, the economy and land use which would result from an increase of the skier limit from 4050 to 4800 per day. Many assumptions were made to develop these estimates, as indicated in footnotes; variations in the assumptions could change any of the numbers, but for the most part the table should provide a reasonable indication of the magnitude of readily quantifiable impacts associated with skiing. As a general concept, the table is based on the following logic: increases in tourism produce a development

TABLE 6-8. POPULATION, ECONOMIC AND DEVELOPMENT IMPACTS OF INCREASED SKIER LIMIT.

This table presents future conditions in the region due to tourism at Taos Ski Valley. Column 2 presents future conditions which would result even if there is no increase in the skier limit nor construction of new high-density development. Column 3 shows the effects due strictly to increasing the skier limit. Column 4 combines the effects of Columns 2 and 3, showing the total future effect of ski valley visitors in the region if the skier limit is increased but no new high-density development occurs. "Skier limit increases" assumes limit on lift ticket sales is raised from 4050 to 4800 per day; reflects a year of good ski conditions (maximum impact). Impacts are the total change for the region as a whole and need not occur only in Twining or Hondo Valley; numbers are rounded off. The changes listed in the table constitute the major impact of expansion of the winter resort complex which could be associated with any of the capacity alternatives providing 85,000 gpd or more and with alternative C. Benefits do not include those from summer use; adverse effects (land, sewage flow) assume summer use is 10 percent of winter use. Table 6-9 considers effects related to the location of any growth which occurs.

FACTORS THAT MAY CHANGE	NO CHANGE IN SKIER LIMIT +	SKIER LIMIT INCREASES =	COMBINED EFFECT
Peak Day Visitation a/ (No. of people)	Skiers = 4050 Visitors = 320	Skiers = + 750 Visitors = + 50	Skiers = 4800 Visitors = 370
Annual Winter Visitation b/ (person days)	10-20 yrs = 520,000 (Now = 275,000)	+ 95,000	615,000
Development Pressure c/	3850 pillows	+ 285 pillows	4135 pillows
Winter Revenues d/	10-20 yrs = $52,000,000 (Now = $27,500,000)	+ $9,500,000	$61,500,000
Jobs e/	1560	+ 190	1750
New Residents f/	0	+ 40	40
Land For Water Rights g/ for Non-Residents	10-20 yrs = 22.5 acres (Now = 12.5 acres)	+ 4 acres	27 acres
Peak Sewage Flow h/ from Non-Residents	165,000 gpd	+ 20,000 gpd	185,000 gpd
Peak Traffic (parking) i/ in Twining	1650 cars	+ 310 cars	1960 cars
Annual Traffic j/	10-20 yrs = 210,000 trips (Now = 115,000 trips)	+ 35,000 trips	245,000 trips

Purpose of table is to establish approximate dimensions of change based on a worst case analysis; many assumptions have been used to develop a straightforward analysis; impacts may vary somewhat from those given here if assumptions are changed.

a. Skiers and visitors in TWSD on busiest day of year; excludes employees. For subsequent calculations, 80% of skiers and visitors are assumed to require overnight accommodations somewhere in Taos area (this is same as present estimated percentage).

b. Average day population is assumed to increase to 85 percent of peak day with or without increase in lift-ticket limit (compared to present ratio of 45 percent). Season is assumed to be 140 days. The projected change due to increase in skier limit (middle column) is that increase over and above what will occur from the increased use of the ski area in off-peak periods (see text).

c. Existing = pillows required by historic peak-day use (4400 skiers and associated visitors; it is assumed this demand was met). Increase (middle column) is difference in pillows associated with 4800 skiers vs 4400 skiers.

d. 1980 dollars, includes direct and indirect revenues; roughly equal to $100/visitor-day. See Table 6-9 for discussion of where these dollars are spent.

e. Direct jobs plus estimated 1.5 indirect jobs per direct job; see note i.

f. Equal to 50 percent of new employees in Twining, based on existing conditions.

g. Involves water for tourists and new residents only; values for winter season are increased by 10 percent to reflect summer use. Existing county residents who ski or work in Twining are not included as they place a demand for water whether or not involved at TWSD. Consumption for snowmaking not included (see section 6.2.6). Consumptive use is assumed to be 21 gallons per day for domestic use and to require 0.8 acres of land for each acre-foot of consumptive use water right; new use decreased by 33% to reflect benefits of water conservation.

h. Total sewage flow generated by tourists and new residents only. Assumes 10 gpd for visitors; 40 additional gpd for overnight residents; projections decreased by 33% to reflect benefits of water conservation; peak day flows factored by 89% to reflect daily use peak week. Existing county residents who ski or work in Twining are not included. (Non-point source pollution assumed to increase in proportion to annual visitation).

i. Assumes every person who visits TWSD makes one round-trip to or from the area daily. For projection of existing situation, 333 of the 625 direct employees work in Twining; for future assumes 76 new employees work in Twining. Assumes 3 tourists/visitors per vehicle and 1.75 employees per vehicle (based on current conditions); no allowance for benefits of shuttle system.

j. Combines assumptions given in notes b and i; summer use estimated at 10% of winter use.

pressure on the community which is reflected in construction of overnight facilities, increased revenues, and some new jobs which are taken by both local residents and newcomers. Collectively the influx of tourists and non-resident employees increases the demand for resources; the table provides information on two of the most quantifiable resource impacts - land required for water rights, and sewage capacity (demand for wasteload assimilation capacity in rivers). Finally, increases in traffic levels are estimated as a function of the increase in tourism and jobs.

Three important conclusions can be drawn from Table 6-8: many impacts associated with Taos Ski Valley may double in the next 10 years or so, even if treatment plant capacity is not increased; raising the limit on ticket sales, facilitated by increasing treatment capacity, would further increase most impacts (beneficial and adverse effects) by 10 to 20 percent; the impacts are regional in character, often occurring outside the Hondo Valley and, in some cases, even beyond Taos County. Each of these points is expanded upon below.

The second column of Table 6-8, 'no change in skier limit,' presents future conditions assuming there is no increase in the skier limit and no high density development within the resort. It is the baseline situation, comparable to the "Lowest Projection" in Table 6-7. The projection includes the effect of growth in off-peak skiing. Annual visitation has been increasing at the rate of 15 percent per year and this trend in demand is expected to continue. Average daily use has been 45 percent of the peak day use. Any type of skier limit, whether 4050 or 4800 per day, will tend to increase the average use in comparison to peak use since peak day use is set. Thus, the forecast is that average use will approach 80-90 percent of the peak within 10-20 years, and skier visitation will double simply due to this increased demand. Obviously, there will be years of poor snow conditions when the off-peak use is low. However, for purposes of a worst-case analysis it is the years of maximum impact which are of most interest.

The doubling of skier activity would effectively double some of the impacts associated with the resort complex. For example, the economic benefits (revenues) from skiing would nearly double and so too would the need for water rights. Other impacts - those related more to peak-day populations - would not change. Thus, the table shows no new jobs being created by this expansion. (Like everything in the table, this may simplify matters; a few jobs could result simply from the change in business conditions.) Traffic impacts also illustrate the difference between annual and peak-day effects. Peak traffic (which influences road safety) will not increase because of off-peak visits; but total traffic (which influences energy use, air quality, etc.) will increase.

The third column of the table shows changes which would occur if the skier limit is increased to 4800 per day. In contrast to the second column, these changes would be facilitated by expansion of treatment plant capacity (unless alternative C is adopted; see Table 5-5). The effect of a nearly 20 percent increase in the skier limit is an approximately 20 percent increase in most impacts - from economic benefits to water rights. The increase in jobs is actually less than 20 percent, because TSV, Inc. employees can now serve 4400 skiers and require only a 10 percent increase to serve 4800.

The impacts defined in Table 6-8 are regional in extent. For example, the total non-resident sewage treatment capacity required to support 4800 skiers a day is about 185,000 gallons per day somewhere in the region. If 80,000 gpd is provided in Twining, then 105,000 gpd must be provided elsewhere (such as septic tanks along the Rio Hondo and Highway 150 and/or treatment in Taos itself). Even if the TWSD capacity is raised to 95,000 gpd, this is just slightly more than half the total treatment which will be required.

Impacts of Expanding Overnight Capacity and Use in Twining. The development of new overnight facilities does not increase the overall impact of skiers but does determine where the impacts would occur. Table 6-9 summarizes how these impacts on population, the economy and land use described in Table 6-8 would be distributed if a 95,000 gpd plant is built. Many assumptions were made to develop these estimates, as indicated in the footnotes; variations in the assumptions could change any of the numbers, but for the most part the table should provide a good indication of the magnitude of where the impacts defined in Table 6-8 are likely to occur. Other capacity alternatives would contribute to a somewhat different distribution of impacts as noted in the table and in the following comments. Large capacity alternatives could also contribute to additional impacts on the regional lodging industry as discussed in the text.

Several interesting conclusions can be drawn from Table 6-9: an increase in the skier limit would create a demand for additional overnight capacity at motels, lodges and condominiums (Table 6-8); this capacity is small enough that it might be provided in TWSD with or without an expanded central treatment plant; it is difficult to predict the impact of providing these pillows in Twining on the lodging industry in Taos; the benefits (revenues and jobs) from ski resort growth are regional in nature; the adverse impacts are concentrated in the Rio Hondo basin and/or along Highway 150 although some also occur elswhere in the region. Each of these points is expanded below.

The increase in off-peak skiing can be absorbed with little need for increased overnight accommodations in the region; existing facilities simply experience a higher occupancy rate. (For simplicity, Table 6-9 assumes no new facilities). However, if the skier limit is raised then there would be a net increase in the need for pillows; Table 6-8 shows the increase to be 285 pillows. This is about a 10 percent expansion of the Taos-area lodging industry. If a 95,000 gpd treatment plant is built in TWSD, then all of this pillow increase can (and quite possibly will) occur within the District. Indeed, the projection in Table 6-9 is that there would be 489 new pillows in lodges and condos and, eventually, another 470 pillows in cabins. Thus, the increase in overnight capacity in Twining would not only absorb the demand created by the higher skier limit, it would provide alternative lodging for visitors who might otherwise stay elsewhere in the region.

TABLE 6-9. DISTRIBUTION OF POPULATION, ECONOMIC AND DEVELOPMENT IMPACTS YEAR 2000.

Effects of expanding TWSD treatment plant to 95,000 gpd capacity. First column lists categories of changes. Second column gives effects which appear to be independent of plant capacity: O - increased off-peak skiing; S - summer growth (estimated at 10 percent of winter use); and C - build-out of cabins on existing platted lots of Pattison subdivision. Third column presents impacts of increased lift-ticket sales (from 4050 to 4800 per day) and increased overnight capacity in TWSD (490 pillows) both of which could occur using on-site systems, but which would certainly benefit if there is increased treatment plant capacity: LT = lift-ticket increase; ON = increase in pillows. Fourth column is sum of effects in second and third columns. Fifth column identifies impacts outside of TWSD. For purposes of comparison, the effects of overnight facilities in Twining (marked by asterisk) would shift to the regional column if there were no treatment capacity available in the District, and if TWSD banned independent treatment facilities for large-scale developments. All numbers are rounded off.

FACTORS THAT MAY CHANGE	IMPACTS IN TWINING WATER AND SANITATION DISTRICT			REGIONAL
	Off-peak + Cabins + Summer	Skier Limit + Overnight Increase	Cumulative Impacts	Impacts Outside of Twining
Peak Day Population a/ (No. of people)	no effect	LT = + 800 visitors LT = + 20 employees ON = + 55 employees*	+ 875; new total 5580	all visitors (5170) would pass through region to reach TWSD; half of new employees in Twining (40) assumed to be new-residents
Winter Visitation b/ (person days)	O = + 245,000; new total 520,000	LT = + 95,000	+ 340,000; new total 615,000	see above
Overnight Capacity c/ (pillows)	C = + 470; new total 765	ON = + 490 (285*)	+ 960; new total 2200	no effect
Winter Lodging Use d/ (person nights)	C = + 56,000 O = + 33,000 new total 200,000	ON - + 60,000 *	+ 150,000; new total 260,000	+ 122,000; new total 232,000
Winter Revenues e/				
Direct				
Skiing	O = + $4,430,000	LT = + $1,710,000	+ $6,140,000	
ON	C+O = + $4,220,000	ON = + $2,770,000*	+ $6,990,000	+ $ 5,960,000
Indirect	None	None	None	+ $15,000,000
Total	+ $8,650,000; new total $18,950,000	+ $4,480,000	+ $13,130,000; new total $23,430,000	+ $20,960,000; new total $38,100,000
Jobs f/	no effect	LT = + 20 for 250 direct jobs	+ 75 for 410 direct jobs	+ 0 = 295 direct jobs
		ON = + 55 for 160 direct jobs (32*)		+ 115 = 1055 indirect jobs new total 1350 jobs
Land For Water Rights g/	O = + 5.6 ac C = + 1.5 ac S = + 1.2 ac new total 15.8 ac	LT = + 0.6 ac ON = + 1.7 ac*	+ 10.6 ac; new total 18 ac	visitors cause increase of 5 acres for total of 9.5 acres new residents require 0.25 acres (Total regional demand, all valleys increased by 16 acres to 28 acres)

TABLE 6-9. (continued).

FACTORS THAT MAY CHANGE	IMPACTS IN TWINING WATER AND SANITATION DISTRICT			REGIONAL
	Off-peak + Cabins + Summer	Skier Limit + Overnight Increase	Cumulative Impacts	Impacts Outside of Twining
Sewage Flow [h]	C = + 11,000 gpd; new total 20,000 gpd using on-site system	LT = + 4,800 gpd ON = + 11,810 gpd*	+ 16,600 gpd; new total 95,000 gpd using plant + 11,000 gpd; new total 20,000 using on-site systems	+ 1520 gpd (for new residents)
Peak Day Traffic and Parking [i]	no effect	LT = + 280 vehicles ON = + 30 vehicles*	+ 310 vehicles; new total 1960 vehicles	all vehicles (1960) pass through region to reach TWSD
Annual Traffic [j]	+ 115,000 trips; new total, 210,000	LT = + 32,000 trips ON = + 3,000 trips*	+ 150,000 new total 245,000 trips	all vehicles pass through region to reach TWSD

a. From Table 6-7; 800 includes skiers/other visitors.

b. From Table 6-8.

c. Capacity increases based on Table 6-7. No new employees assumed to reside in TWSD. Of the 2200 pillows, 135 are (and would continue to be) occupied by employees. All existing employees not living in TWSD are considered to be residents of the area and are not counted as contributing to the demand for overnight capacity.

d. Assumes 140-day ski season; overnight stays = 80% of winter visitation (based on current conditions); occupancy in TWSD up from 66% to 85%; pillow demand not met in Twining allocated to region.

e. 1980 dollars; increases include direct and indirect revenues (roughly equal to $100/visitor-day); all indirect revenues assigned to region; direct revenues apportioned: ski-related expenditures to Twining, other direct expenditures to location of overnight stay, this overstates expenditures in Twining since cabin residents and guests will purchase many items in Taos.

f. Direct jobs plus 1.5 indirect jobs per direct job; all indirect jobs assigned to region.

g. Consumption for snowmaking not included (see section 6.2.6). Consumptive use is assumed to be 21 gallons per day for domestic use and to require 0.8 acres of land for each acre-foot of consumptive use water right; all new development decreased by 33% to reflect benefits of water conservation. See section 6.2.4 for discussion of how these acreage requirements compare to existing water rights held by TWSD; TSV, Inc; and Pattison Trust.

h. Assumes 10 gpd for skiers, 40 additional gpd for overnight residents; all new development decreased by 33% to reflect benefits of water conservation; peak day flows factored by 89% to reflect average daily use peak week. Regional flows are for overnight portion only (during day these people would be in Twining). Addition of infiltration (1600 gpd) to total high-density flow accounts for the 95,000 gpd capacity of a new plant.

i. See note i, Table 6-8. Increase in overnight capacity in TWSD could decrease traffic because more persons would stay in area and not commute to/from Taos; however, this could be offset by evening travel to Taos (to go to restaurants, shops etc). No allowance for benefits of shuttle system.

j. See note j, Table 6-8.

Building a smaller plant would not necessarily prevent growth of overnight accommodations in TWSD. If the treatment plant is expanded only enough to support the increased skier limit, then any new pillows in Twining would require on-site systems for sewage disposal. This may change the character of development (for example, there might be many three and four-unit condos instead of two or three large ones), but it would not cause a violation of the stream standards (see wasteload allocations, Appendix B.4) and it would be consistent with TWSD policies (see section 5.3.2).

If new pillows are not provided in Twining, any increase in the skier limit will create development pressures in other parts of the region. The demand for 285 new pillows (see Table 6-8) would most likely be reflected in new lodges and condos in areas such as Amizette, Valdez, Arroyo Seco and Taos; it is not possible to predict exactly where and how. Should the development be concentrated in the Hondo Valley or along Highway 150, it would tend to increase area land prices, result in conversion of rural land to traveler services and increase the visible presence of tourists.

If the pillow demand is met in Twining, the effects on existing overnight accommodations elsewhere would be mixed. In good snow years there would be no adverse effect (see Table 6-9), but in a poor snow year rooms in Twining could capture some of the market which otherwise would be directed toward Taos and the larger region. Due to the overall projected increase in winter ski visits, the net effect should still be an increase in local business.

Alternatives such as G, which would facilitate very large growth in overnight accommodations in Twining, could adversely affect the regional lodging business by drawing away lodgers from established facilities. The area most likely to be affected would be Taos County. There are an estimated 2000 pillows in the county excluding Twining. Under the maximum capacity alternative, 3,500 people could be housed in the ski valley, nearly 2800 in lodges and condominiums. This degree of growth could draw over 50 percent of the business away from regional facilities even on a peak day in a good snow year. (This ignores other factors, such as possible increased winter tourism not related to Taos Ski Valley.) Should such development occur in Twining, it could restore the historic summer/winter differential in local business and tourism jobs in Taos. The effects would be particularly hard on small or marginal businesses. In a good year, these effects would largely be offset by the projected doubling of skier visits throughout the winter; in a poor snow year, however, these impacts would be very evident.

The revenues generated by skiing are both direct and indirect (see section 6.6.1). While most of the direct spending would be in Twining (for recreation, food and lodging), much would be elsewhere in the region (especially in motels, restaurants and shops). Table 6-9 identifies the direct revenues from overnight guests staying in the region. These figures may overestimate regionwide revenues from the ski area, since they reflect good ski years, and not average conditions. On the other hand, the numbers underestimate direct regional expenditures because the table assumes that persons lodging in Twining make no purchases elsewhere in the region.

Twining receives essentially none of the indirect revenues from skiing; these economic benefits accrue to the Taos region. Table 6-9 indicates that these revenues are substantial; however, in the community the income may not be recognized as coming from skiing. These funds are generated by the purchase of goods and services to supply tourist oriented facilities and their suppliers. Therefore, as an example, the money payed to a local bakery for bread served to tourists, and in turn part of the salary of the baker, expenditures for flour, etc. are indirectly generated by the tourists. In this way a large portion of the economy actually shares in the benefits of the tourist dollar.

The available data indicate that over half of the economic benefits from the resort complex accrue in the region rather than in Twining; the percentage of regional benefits is greatest if there is minimal overnight capacity in Twining. Of course, in Twining itself, every member of the community depends on and can clearly see income from skiing; as individuals, these people benefit substantially from the resort. To a lesser extent, this is true for tourist-oriented businesses and employees in the region including construction workers building new facilities. In contrast, residents who do not own or work in a tourist business often receive a lesser share of the benefits (on an individual basis). However, it is still true that the funds generated by the resort are widely distributed and contribute, at least partially, to the incomes of a substantial share of the county population.

Based on existing patterns, the majority of new jobs would be filled by residents of the area (both natives and persons who have relocated for reasons other than the prospect of a resort job). However, following current trends, it is likely that about half the new employment in the ski valley would go to persons who move to the county as a result of the job opportunity. All indirect jobs would be expected to go to local residents who would be employed by regional businesses.

One impact of major concern to residents of the Hondo Valley is the prospect that growth in Twining would force TWSD to purchase water rights from area farmers, thus drying up agricultural land. Prospective impacts on water rights are discussed in section 6.2.7; it appears that no new water rights would be needed by the District if growth is no greater than associated with a 95,000 gpd plant. However, up to 15.15 acres of land already owned by Taos Ski Valley, Inc., would be retired from production to meet winter domestic needs. This is a worst-case estimate (unless TWSD should no longer have access to the Pattison water right).

If the District can utilize its San Juan-Chama Project water, the retirement would be only about 4 or 5 acres to offset snowmaking and summer uses (with the actual amount depending on the outcome of water rights hearings). In either case, the retired land would be less than one percent of the 2735.7 acres of water-rights land in the valley. Thus, while the retirement of farmland does go against the principle of maintenance of an agrarian society, the actual magnitude of the impact is small. (The same conclusion applies to the highest growth projection, alternative G, for which up to 22 acres of agricultural land would be needed.)

The loss of this TSV, Inc. acreage from production is likely to be very visible (especially through publicity over the hearings), and there may be controversy over the priority of the transferred rights (among other issues). However, the size of the change suggests that if development in Twining is as described in Table 6-9, it would not have the kinds of significant cultural impacts which have occurred elsewhere in New Mexico where there has been wholesale transfer of irrigation rights. Most of the impact relates to the expansion of off-peak skier use and snowmaking; as shown in Table 6-9, a small amount relates to the expansion of overnight capacity and only 1 acre is related to the increased skier limit.

Another impact of concern to area residents is increased traffic. The calculations given in Table 6-9 reflect a worst-case scenario, in which proposed shuttle services do not flourish. The impacts could be less in that with more overnight capacity in Twining, there could be less commuting along the road (especially during rush hours). On the other hand, there might be more traffic in night time periods as persons lodging in Twining travel to and from Taos for dining and entertainment. The traffic counts shown in the table are much below the capacity of the highway. Still, a proportional increase in congestion, disruption of local traffic, and accidents can be expected. Also, noise and air quality impacts would increase (see 6.3.4) as would energy use (6.7.4).

Water-quality impacts associated with TWSD growth are discussed in section 6.2.7. While the potential for increased impacts is evident, successful operation of new treatment facilities and non-point source control could result in a significant net improvement in water quality. In addition, Tables 6-8 and 6-9 illustrate a major point, which is that even with an 80,000 gpd plant, the increase in off-peak skiing will also increase wastewater discharges outside TWSD, thus potentially producing impacts on water quality (unless proper treatment is provided).

Cultural Impacts. As discussed in sections 5.3.3 and 5.3.4, the impacts of TWSD growth on the culture and lifestyle of the area are a major concern to virtually every citizen; however, perspectives on what constitutes 'significant change' also vary among individuals. The economic benefits shown in Tables 6-8 and 6-9 are large and a major reason why many citizens of Taos support development of the ski resort complex. Some citizens support even more growth than projected and do not want to see a limit set on lift-ticket sales. Given the benefits, it is important to understand why many other citizens oppose development. This subsection discusses potential cultural changes associated with growth in Twining, in order to help explain why the debate over such growth is so intense.

Within TWSD, many existing residents are concerned about growth of what is now a relatively small mountain community. During the winter, only about 150 people actually live in Twining and even on peak nights guest populations are less than 1100. The potential that evening use of the area may nearly double, combined with increased duration of use, could so intensify activity in the resort that the intimate nature of the existing community would be altered.

Much more debate has focused on changes outside TWSD - and specifically on the lower Hondo Valley and the Taos region in general. Section 6.6.2 discusses the many complex factors which have influenced cultural change and the decline of agriculture in the area. Based on that section and on the magnitude of change indicated in Tables 6-8 and 6-9, the following statements provide a perspective on the cultural shifts brought about by growth of the ski resort.

1. The most substantial factors causing the decline of agriculture are not related to increased tourism, but to factors such as: natural limitations of soil and water supply; the recent trend toward reduced runoff; the loss of land grants; decreases in the size of irrigated parcels; and the national trend toward food markets which are supplied by large, mechanized farms. It is difficult to envision any scenario under which agriculture could again become the economic mainstay in Taos.

2. Despite these factors, the agrarian lifestyle remains an essential part of the Taos culture. Most Taosenos in rural areas will go to great lengths to retain their traditional way of life, even if farming is a part-time, subsistence occupation. Thus, changes which adversely affect farming are important not so much because of their direct economic effect, but because they make it more difficult to sustain the traditional lifestyle.

3. The economic growth of the community (some of which is related to winter tourism) has a mixed effect on the rural lifestyle. On one hand it provides wage jobs which enable many people to stay on the land, but it has also increased the need for cash to pay for the necessities of life. Subsistence agriculture generates little cash; often the most valuable asset the farmer has is his land which growth has made increasingly valuable. Thus, it is harder to stay on the land and increasingly attractive to sell.

4. Specifically, growth of the ski industry has significantly contributed to the supply of local jobs, including many jobs which are not in Twining. On the other hand, while the indirect jobs do provide for professional, skilled employment (e.g. bankers, accountants, and craftsmen) most are in the service sector, low-paying, and low-skilled; many job seekers consider this unsatisfactory employment.

5. Tourism also encourages somewhat higher prices. The effects of TWSD appear to be small with the possible exception of land prices in the Valdez - Arroyo Seco area (see Appendices D.4 and D.5). The projected growth in skier use of Twining could further increase land prices, regardless of the plant capacity alternative chosen. For example, some additional commercial development (restaurants, gas stations, etc.) would likely result from the approximate doubling in the winter-long number of skiers. Based on the historic trend, in 2000 land prices in Valdez and Arroyo Hondo would be several thousand dollars higher than in comparable communities farther from the ski resort. This is a worst-case analysis;

given the small acreage involved, the changes could be much more modest. Agricultural/rural uses still would be by far the principle land use in the area. However, to the extent that the highway becomes a corridor of strip commercial development, there would be a significant change in the aesthetic character of the area between Taos and Twining.

6. Motel and lodge development outside Twining may also occur for the same reasons described in item 5. In this respect, a larger treatment plant facility in TWSD, and the associated expansion of overnight accommodations within the District, could reduce development pressures elsewhere. (Even without a larger plant, the same effect is likely because of development in Twining serviced by on-site systems.)

7. A major fear of downstream residents is that the water supply will be affected by development in Twining. Further reduction in the supply of irrigation water, which is already critically short, could lead to abandonment of farming and loss of the land and lifestyle. Data show clearly that the reduction of irrigation flows is not due to growth in Twining nor would limited growth have a significant effect. However, existing conflicts regarding the priority of water rights might be heightened.

8. Beyond economic change, the influx of outside values into the community would be a major factor responsible for alterations of the area lifestyle. Tourism is one of several influences - among them radio, television, schooling, travel, etc. - contributing to this influx (see 6.6.2). The daily flow of skiers and other visitors to the ski valley increases residents' exposure to different attitudes, lifestyles and affluence. To the extent that tourists stay in Twining, this presence would be reduced, although an air of exclusiveness would also be fostered. To the extent that increasing numbers stay elsewhere in the region, there would be greater exposure to a different lifestyle. For county residents who resent the presence of tourists, either situation will increase their concern and the friction between the two groups.

9. The present patterns of impact distribution would continue, and perceptions of these impacts would be unchanged. These patterns clearly show a positive ratio of benefits to adverse effects within TWSD. Elsewhere the pattern is less clear and may vary depending on the individuals involved. While many citizens may enjoy a net benefit from the direct and indirect revenues generated by winter tourism, others may not. For at least some persons in the lower valley, the adverse effects (traffic, some loss in water quality compared to pre-development conditions) would not be offset by benefits.

It is difficult to combine all these factors and say that there would be 'so much' cultural change resulting from development in Twining. Part of the difficulty is that so many other factors influence the nature of the area (see 6.6.2); the actual locations of new restaurants, motels, etc. cannot be known in advance; and the significance of the changes are perceived differently by different members of the community. In many respects the impacts are symptomatic of what is often termed 'progress'. Thus, analysis of the impact becomes an attempt to determine if such progress is truly beneficial or instead destructive of the traditional way of life, and further, if these kinds of changes are inevitable.

While the subject of 'progress' is too broad to be addressed fully in this document, a few generalizations are possible. First, rural societies throughout the world have been evolving in the face of modern economic and cultural pressures, with the consequent loss of traditional values. Most often, tourism is one such pressure and it no doubt has contributed to cultural change in Taos as well. Thus, it may be speculated that the projected development of Twining could play a role in the continuing shift away from a traditional, agrarian, Hispanic-Indian society. Perhaps comprehensive, countywide land use planning - or some other type of locally derived political action - could slow such change, or even redirect it. Anything short of such planning would be unlikely to have an effect.

Second, the development of Twining is a highly visible symbol of a type of progress which some people embrace and others reject. For example, to many of those interested in economic growth the large revenues generated by skiing are very welcome. To those who want to maintain the agrarian tradition, the revenues simply represent the acquisition of wealth by a few through the use of resources which once belonged to many. The 'high-profile' nature of the resort in itself is often cited as a cause of cultural stress, since skiers are usually visibly affluent and engaged in recreation ('play') using public resources (and perhaps a federally funded treatment plant); some Taosenos are much less affluent and many consider themselves as needing these same resources for survival.

The debate about development in Twining is certainly important in its own right. For example, historic pollution problems must be solved and downstream communities must be protected against any violation of the stream standards which could result from growth of the resort. However, in many respects the debate is a symbol of community interest in the whole question of 'progress' and cultural change. The decision about the best size for a TWSD treatment plant thus becomes a decision in principle about the future of the region. Those who are especially concerned about survival of the existing culture (and who certainly don't want to speed up the change) strongly advocate a smaller facility that won't encourage new development in Twining (and which might even play a role in slowing development). Those who encourage (or at least accept) tourist-based economic development and who consider tourism a basically clean industry which benefits rather than conflicts with the natural culture are supportive of a larger capacity wastewater treatment plant for Twining.

Infrastructure Impacts. Twining's infrastructure should be sufficient to accommodate the growth associated with the 95,000 gpd plant, with two exceptions. Recently proposed improvements to the water system are designed to meet current needs, for details refer to Appendix C (BLL, 1980). Projected growth would require some expansion of the system, particularly the transfer and development of additional water supplies (see section 6.2.7). The other area of potential impact is on parking facilities which are to be expanded to hold 1300 vehicles (USFS, 1981b). Projections in Table 6-9 indicate that there might be over 1900 vehicles in Twining in the future. Perhaps a hundred or so may be located in private parking lots, leaving up to 500 cars without a parking space. This impact would be offset by use of the shuttle and increased private parking but it is possible that facilities will have to be expanded further in the future increasing surface runoff and visual impacts.

In the region, the most likely effects on infrastructure are related to increased highway use and possible development in smaller communities. Highway 150's capacity is adequate to handle future use; however, the road is deficient from a safety standpoint (sharp curves, etc.) and increased use could increase the accident rate and require improvements to the highway. Some increased traffic congestion in Taos is also possible during skiing "rush" hours.

The water and sewer systems in most small communities have very little excess capacity. New development in these areas would probably require system expansion. Some local traffic circulation problems could also occur.

6.6.7 Impacts of Other Types of Alternatives

The various alternatives described in section 5.4 could have four types of impacts on the socio-economic environment: rate increases, adjustment to water-saving practices, revised development patterns, and expectation of successful pollution control. In addition, the extension of sewers to existing base area development (Kandahar) and five cabins now having holding tanks would relieve these facilities of their present wastewater disposal problems.

Rate Increases. In addition to plant construction and operation, the collection system, on-site system management, and rate design alternatives would all affect the rates of District residents. To meet the costs associated with the construction and management alternatives (see section 5.4 and Appendix B), water/sewer rates paid within the District would have to increase substantially, perhaps by a factor of two considering both the sewer system rehabilitation and the water system improvements. Assuming that the rate design described in 5.4.8 is adopted, most of these increases would be passed through to skiers and visitors who use the area (and who are the main reason the facilities are needed).

Still, the proposed rate design would affect existing residents and property owners, through payment of three major fees. The first would be an annual assessment for system users, based on usage. This fee is unspecified but is expected to be at most $50 per pillow per year. It would be used to develop an operating/reserve fund and would be assessed only as needed to maintain an adequate fund. The second would be a hookup fee, charged to those who develop new or expanded commercial facilities in the base area. If this fee is set by market forces, and the demand for hookups continues to outpace supply, the charge could be large, perhaps several thousand dollars per unit (as a one-time cost). The third would be an assessment for owners of on-site systems to pay for the on-site management service. During the initial years this could amount to $150 per owner each year (which, proportionally, would be a greater impact than the increases faced by those who are hooked up). As the number of on-site systems increases this fee would be reduced (disregarding the effects of inflation).

Water Conservation. The use of water conservation measures as described in section 5.4.6 would require residents to adjust to the use of dry or extremely low flush toilets in order to significantly reduce sewage flows and conserve area water supplies. The benefits of this alternative would include reduced water and sewer fees (because smaller water and sewer systems would be needed and because rates are based on use); also, this step would represent to downstream residents a positive effort on behalf of TWSD to reduce its impact on area resources.

However, operation of dry toilets has met with varying success even though the systems have proved reliable in some installations. They do need to be installed properly and consistently maintained. Basically this would require: care in selecting persons to do the installation; in some cases, special consideration in house design to accommodate the system; and periodic removal of waste (generally once a year or so depending on use and system design).

Even with these precautions, problems can occur for reasons which may include (EC, 1980):

- disturbance of the system through changes in the moisture balance or overloading (resulting from long periods of non-use or heavy peak use);

- corrosion of electrical units (from excess humidity), causing failure of fans or heating units, and stopping the bacterial action;

- possible need for special precautions in the disposal or use of the compost which is produced by the toilet.

With system failure, the potential for offensive odors is significant.

These problems can be minimized through a regular maintenance schedule, as could be undertaken should TWSD adopt an OSS management program (Section 5.4.2), intended in part to ensure that the balance of each system is maintained. Another consideration facing infrequent cabin residents is that the system must be kept in a heated space. This would require that the electricity be kept on while the residents are gone, an extra cost and inefficient use of energy.

Extremely low-flush toilets, (one litre versus 18-20 litres) also offer significant savings on water use. Their operation and installation requirements are similar to standard fixtures, and require little or no adjustment on the part of the users.

There is likely to be at least some public resistence to requiring dry toilets in all new construction, because of concerns over system failure, odors and even health hazards. Lodges and condominiums, particularly, may be concerned that the potential for failures could hurt their business. Extremely low-flush toilets are likely to be more readily accepted by the public, and they still offer the potential for significant water savings. Should TWSD adopt a phased hookup policy (see below; and section 5.4.9), there would be time to demonstrate the various available systems in Twining and to determine construction and operation standards. This would also provide an educational benefit in the water conservation program.

Hookup Policy. As described in section 5.4.9, TWSD is considering hookup alternatives which involve phasing in of new hookups, the timing depending on performance of District facilities and compliance with appropriate regulations. The hookup policy would have several major impacts over and beyond contributing to the objectives of quality assurance.

1) Intially, it would delay construction of new facilities desiring hookups until the plant is completed and operating performance tested, except for development using on-site systems.

2) Once the moratorium is lifted, delays would continue, on a priority basis, for those not receiving a new hookup.

3) Eventually, all growth associated with the 95,000 gpd projection (and perhaps some additional growth) could be serviced. However, at least theoretically, TWSD could ultimately stop all development using on-site systems (except for total recycling systems) due to limits on total pollutants which may be discharged from both the plant and on-site systems.

4) Delays in development would have an adverse financial impact on property owners who seek to put their land to a more intensive use.

5) For those who turn to on-site systems, the costs of development are likely to be greater than for those who acquire hookups. Based on state regulations (Appendix A.1) the only systems which would receive approval are those which discharge to ground water and which have a capacity of 2,000 gpd or less (or involve total recycling, see below). The use of such systems would change the pattern of development because only small condos and lodges (perhaps 2-4 units each) could be serviced.

6) Those who want to develop at a large scale, and for whom hookups are not available in a timely fashion, may turn to extremely expensive alternatives such as total recycling (alternative 13, chapter 5).

Expectations. The quality assurance program, if adopted, would raise expectations on the part of all area residents that the long-standing pollution problems in the Rio Hondo could and would be solved. If the program works as described in section 5.4.9, these expectations would be realized. Relationships between TWSD and those downstream would improve, both because of TWSD's visible progress toward protection of the river and because of the improved water quality itself. However, should there again be significant violations of effluent limiations by TWSD, conflicts among area residents would recur and quite probably be heightened.

6.6.8 Impacts of EPA and Other Agency Alternatives

Virtually all of the potential impacts described in Tables 6-8 and 6-9 would occur irrespective of EPA decisions regarding project funding. This is because essentially all growth impacts can occur independently of any decision made regarding plant size. The impacts of alternative B are inevitable so long as the resort complex remains viable and TWSD meets its obligations to eliminate point source pollution. A larger plant would facilitate more growth in Twining but a smaller plant would not prohibit or even effectively discourage growth. Provided only that there is sufficient economic incentive, development to or above 95,000 gpd can be accommodated through on-site systems or independent treatment plants, both of which can be designed to meet applicable regulations. To effectively control growth and its impacts would require public action such as zoning or some other form of comprehensive land use planning.

Still, EPA's funding decision does have a practical significance if the agency provides a source of money to TWSD which otherwise would have to be raised from the property owners and from recreationists; the greater the funding, the greater this benefit. Should EPA fund improvements in Twining the impacts discussed above may occur more quickly. Absence of EPA funding would place the costs of environmental protection and growth solely on those who benefit most directly from the presence of the resort; based on historic trend and local economics it appears that development to at least the equivalent of 95,000 gpd would occur. EPA's decision may be taken by many area residents as at least an indication as to the merits of the various arguments over area growth. However, in actual fact, EPA's decision will relate to a number of issues; resolution of the complex questions about economic development and cultural stability will be left to the citizens of Taos County.

In many respects, one of the most significant decisions has already been made (by TSV, Inc.) and accepted by the U.S. Forest Service. This choice, to limit skiers to a maximum of 4800 per day, will place a definite upper limit on many of the impacts (both beneficial and adverse) associated with the resort complex (see USFS, 1981a and 1981b).

6.7 ENERGY AND OTHER RESOURCES

The major resources associated with all the alternatives are energy and materials for construction and operation of a treatment system, as well as the energy associated with traffic which would accompany development. Analysis of these resources indicates the general magnitude of effects of the alternatives; it does not provide an exhaustive inventory of resource use.

6.7.1 Existing Conditions

Treatment Plant. The TWSD wastewater facilities currently use about 120,000 kilowatt-hours (kwh) of electricity per year. Chlorine, used for disinfection, is added at the rate of 8 mg/l; or 1190 pounds total for 1980. This amount of chlorine requires approximately 1550 kwh of energy for its production off-site.

Vehicles. As indicated in Table 6-8, about 104,000 vehicle trips are made to Twining during a good ski season. Assuming all these are round trips from Taos (38 miles), and using the New Mexico average mileage figure (12.2 miles/gallon) this represents consumption of 324,000 gallons of gasoline.

6.7.2 Impacts of the No-Action Alternative

Under the no-action alternative, there would be no change in resource use for wastewater treatment. Traffic would increase to 196,000 vehicle trips per ski season, which would add the consumption of 286,000 gallons of gasoline to current levels. If a shuttle bus system is used (see USFS, 1981a), considerable reduction in petroleum use (even compared to current levels) could be realized. Use of a shuttle system would also have positive impacts on air quality, safety, noise, sediment loss (due to parking lots), and general aesthetics in the area.

6.7.3 Impacts of Treatment Alternatives

The primary purpose of improving the treatment of Twining's sewage is the preservation of a valuable resource - the Rio Hondo. However, treatment of wastewater also requires expenditure of resources - energy, material, labor, and money. The relative consumption of resources among the various treatment alternatives can be approximated from their relative costs (Table B-1), since cost represents the value of a material and the energy used to produce it.

The nature of these costs can be illustrated for TWSD's preferred alternative (alternative 1; conventional, 95,000 gpd). Construction of a new conventional treatment plant would involve the consumption of various materials for equipment and structures, including 208 cubic yards of concrete, 853 cubic yards of sand, 840 square yards of asphalt, and 1000 feet of PVC pipe (BLL, 1981, App. E). Operation of the plant would consume 242,910 kwh of electricity per year, an increase on the order of 100,000 kwh over current requirements. Yearly use of lime and carbon dioxide is projected to be 2,700 pounds and 5,760 pounds, respectively.

Renovation of the existing plant (alternative 12) would require less consumption of building materials, but would use approximately the same amounts of electricity and chemicals. Aquaculture is reported to use less energy, or rather it uses "free" solar energy via algae; this has yet to be confirmed. Lime, carbon dioxide, and a disinfecting chemical would still be used in this alternative. Composting toilets actually provide a resource in that the compost can be used for fertilization. However, this alternative would require a large amount of electricity - on the order of 500,000 kwh per year - for heating toilets to ensure proper bacterial action.

6.7.4 Impacts of Capacity Alternatives

Growth at the ski resort would increase resource use in the watershed, including energy and materials used for new construction and energy associated with operation of the entire complex. Some members of the public have commented that the recreation industry is inefficient in its use of resources. From the perspective of Taos County, it is not clear that this is true since the economic production from the industry is large and the local resource consumption does not appear to cross any environmental threshold - i.e., a resource near exhaustion or unable to absorb expected impacts. The most critical natural resource is water, which is in short supply (for reasons not related to the resort); stresses on the quality of this resource should be controlled within limits established by state and federal regulations.

If a larger capacity alternative is chosen (95,000 gpd), traffic is projected to increase to 231,000 vehicle trips during the ski season. This would result in consumption of 396,000 gallons of gasoline over present levels, compared to 286,000 gallons if the no-action or a lower capacity alternative is selected. However, limiting skiers at Taos Ski Valley would probably not mean that the petroleum would not be used; rather, it most likely would be used for travel to other ski areas in New Mexico or Colorado.

6.7.5 Impacts of Other Types of Alternatives

Ozone requires more energy for its production than does chlorine. Ozone production for alternative 1 would use 6,570 kwh of electricity per year. If chlorination were used, 2,250 kwh would be consumed to produce the chlorine off-site; some energy would also be required to transport the chlorine to the treatment facility. The greater energy cost of ozone is being considered in order to avoid the toxic effect of chlorine residuals in the Rio Hondo. If chlorination, dechlorination and reaeration were used to gain the same benefits, ozone would prove to be less energy intensive.

Money, used to fund the treatment facilities, is another resource which would be used. Various rate structures were discussed in section 5.4. The impact of increased sewer rates on affected residents is discussed in section 6.6.7.

Use of the treatment plant effluent for snowmaking would represent a considerable expenditure of energy in order to pump the water from the treatment plant to the snow machines. The two snow machines presently used by TSV, Inc. consume approximately 10,000 KWH of electricity per year. A much greater amount than this (by an order of magnitude or more) would be required to pump the effluent up the mountain.

Use of sludge for fertilization would provide a valuable resource; however, runoff from the sludge might add excessive nutrients to the Rio Hondo. The energy value of the sludge could also be a benefit; however, for cost reasons the facilities plan proposes no energy renewing processes.

6.7.6 Impacts of EPA and Other Agency Alternatives

EPA's funding options would not have a significant impact on resources unless the agency determines that one of the higher cost (resource intensive) options is cost-effective. A policy by some agency to require use of a shuttle system for transportion to the ski area would reduce the magnitude of nearly all impacts, even below current levels.

6.8 SUMMARY OF ADVERSE IMPACTS, ENVIRONMENTAL TRADEOFFS AND RESOURCE COMMITMENTS

6.8.1 Adverse Impacts Which Cannot be Avoided

With minor exceptions, all of the adverse impacts described in this chapter would occur as the result of: a) expanded use of the resort complex; and b) the investment of resources to control pollution from the area. Table 5-6 quantifies many of the unavoidable adverse impacts.

The impacts of resort expansion would be similar and perhaps identical regardless of the capacity alternative finally implemented; this is because (as discussed in section 5.3) most of the impacts relate to growth in off-peak use, and the remainder can occur from independent treatment plants as well as from an enlarged TWSD plant. For the same reason, the adverse impacts are likely to occur with or without EPA funding except that it is possible that EPA funding might facilitate the growth to some degree and hence contribute to the likelihood that the impacts will in fact occur. Any impacts associated with growth that might be a result of EPA's funding choice will have an impact on downstream users of the river, especially with regard to small transfers of water rights and increased traffic.

The investment of resources is a necessary step toward compliance with environmental standards. All six of the semifinal treatment alternatives would be expected to provide such compliance, as would all capacity alternatives of 95,000 gpd or less. If EPA funding is limited or not provided, the TWSD would still be responsible for the improvements necessary to meet the proposed NPDES effluent standards. The absence of EPA funding would have a negative economic impact on members of the District who would then be responsible for all costs associated with improving the plant and meeting appropriate standards.

6.8.2 Short-term Uses of the Environment versus Long-term Productivity

Upgrading of the treatment facility would promote long-term productivity by improving the water quality and ecology of the Rio Hondo. In turn, this would benefit use of the river for fishing, irrigation and other purposes. EPA funding for the most cost-effective treatment alternative would contribute to the achievement of these benefits.

Expanding the size of the resort would involve a tradeoff of several types of resources, all generally involving long-term productivity. As summarized in Table 5-6, these tradeoffs generally involve: economic benefits to Twining and the region versus some adverse environmental changes in the Rio Hondo watershed and along State Highway 150 (especially some adverse ecological impacts in the river just below TWSD; probable retirement of irrigated lands in order to transfer TSV, Inc.'s water rights into the area; congestion, noise and exhausts from increased traffic; and possible added stresses which influence cultural change).

No evidence has been found to indicate that these environmental changes would cross any fundamental ecological threshold and thus in themselves alter the character of the environment. The cultural changes could, in conjunction with many other forces acting on the area, and if not forestalled by local planning actions, accumulate to the point that the agrarian lifestyle of the region would be significantly diminished. These impacts are expected to occur from either capacity alternative B or E and are not dependent on the level of EPA funding (if any). Complex questions about economic development and cultural stability which relate to the expansion of the TSV resort community must be resolved by the citizens of Taos County.

6.8.3 Irreversible and Irretrievable Commitments of Resources

Major categories of resources to be utilized by the proposed treatment and capacity alternatives were identified in section 6.7 and include energy, construction materials, labor and capital. These commitments are substantial, as is necessary if the pollution problem is to be solved. The commitments are largely irretrievable. At least some additional growth of the area appears inevitable (irreversible); the larger capacity alternatives would facilitate this change (but the smaller capacity options would not prevent it).

CHAPTER 7
COORDINATION

7. COORDINATION

7.1 PUBLIC PARTICIPATION PRIOR TO RELEASE OF DRAFT EIS

Scoping Meeting. EPA held a formal Scoping Meeting in Taos on October 2, 1979. Notice of the meeting was published August 30, 1979, in Spanish and English. The meeting was conducted for the purpose of identifying issues for consideration in the Environmental Impact Statement. The meeting was attended by over 300 people; 24 made oral presentations.

A total of 197 letters were received for inclusion in the official record. Of these, 24 were form letters supporting EPA funding of improvements to the Twining wastewater treatment system. Eight of those were from people at Taos Ski Valley, while one each was from Des Montes, Arroyo Seco, El Prado and Albuquerque. Twelve of the form letters were signed, but included no address. Of the 173 non-form letters, 167 included statements in support of EPA funding for wastewater treatment improvements at Twining. About half of the letters originated in Taos County, one fourth from other parts of New Mexico, and one fourth from out of state. One of the original letters included with it a number of petitions expressing opposition to "the issuance of a 1980 Step 2 and 3 federal grant to the Twining Sanitation District, Taos Ski Valley, for purposes of constructing a sewage treatment plant" and "to the further pollution of the Rio Hondo by another sewage treatment plant at the Taos Ski Valley." The petitions had six different wordings, one of which was in Spanish, and they had a total of 605 signatures.

A number of groups and individuals participated in the scoping process and many have remained involved throughout the development of the facilities plan and this draft EIS. Involvement by the public in these processes has been encouraged and welcomed by EPA. The largest single source of input from outside the District has been provided by the Committee to Save the Rio Hondo (CSRH), a well-organized group of lower valley residents concerned about the environmental quality of the Rio Hondo watershed. Many are members of families that have lived in the valley for several generations.

Section 7.2 discusses the issues raised at the Scoping Meeting and EPA's responses.

Citizens Advisory Committee. In order to maximize public input during the EIS process, the Twining Water and Sanitation District Board appointed a Citizens Advisory Committee consisting of representatives of the various public sectors potentially affected by any proposed action. The group was formally organized on October 1, 1979. The Committee is comprised of persons in substantially equivalent numbers from the following categories: private citizens, public interest groups, public officials and those with substantive economic interest in the project. Membership on the committee is not limited to TWSD residents, but includes residents of the affected areas, including the Rio Hondo Valley and the Town of Taos. The committee has been continuously involved in the EIS process, including review and comment on: (1)

alternatives examined; (2) the preferred alternative; and (3) impacts of the major alternatives.

A list of committee members follows.

1. Public Officials	Representing
Charles Kleiner	Twining Water and Sanitation District
Sonny LaSalle	U.S. Forest Service
Richard Romero	Taos Pueblo
Jack Suttle	Taos County
2. Economic Interests	
Lisa Harner	Rio Hondo Condominiums, Twining
Mike Rice	Chamber of Commerce and El Pueblo Motor Lodge, Taos
Doug Terry	Terry's Sports, Twining
Ron Oest	Downstream irrigation interest
3. Public Interest Organizations	
Manuel Ortiz	Hondo-Seco Development Association
Faby Teter	Committee to Save the Rio Hondo
Jeri Vargas	Taos Coordinating Council
(substitute: Larry Frank)	Committee to Save the Rio Hondo
4. Citizens	
Roy Bernal (home: Arroyo Seco)	
Jim Levy (home: Arroyo Hondo)	
Paul Sears (home: Taos)	
Larry Taub (home: Taos)	

Following the Scoping Meeting, the CAC took the lead in the public participation process and accomplished the following.

1. Depositories for written information were established as follows:
   - A. CAC office, initially at First Northern Plaza, Taos; now at the home of Jack and Doris Schact, Public participation coordinators, Taos (505-758-3864);
   - B. TWSD Administration Office, Twining;
   - C. Harwood Foundation Library, Taos;
   - D. Taos Pueblo Administration Office, Taos Pueblo.

   All minutes and other documents identified in this chapter are available at these depositories.

2. Frequent committee meetings were held (21 by mid-May, 1981), with every meeting open to the public and announced in the Taos News and on Taos radio station KKIT.

3. On February 5, 1980, a public meeting was held at Taos to discuss the existing situation based on information gathered by the consultants. As with the Scoping Meeting, attendance was large and input was extensive. The emphasis of questions and statements was on the need to effectively resolve present and future environmental problems, especially with respect to water quality. The Responsiveness Summary of this meeting is available for review.

4. On July 15, 1980, on the recommendation of the CAC, a contract was negotiated between the Twining Water and Sanitation District and Mesa Consultants (Jack and Doris Schact) of Taos to act as public participation coordinators. At this same time, the committee recommended that Paul Robinson of the Southwest Research and Information Center in Albuquerque serve as Technical Advisor for the CAC.

5. To be better able to digest and evaluate the substantial amount of documentation provided the CAC by the consultants, CAC Chairman Larry Taub appointed sub-committees on Growth, Environment and Facilities. Fifteen sub-committee meetings were held between the regular CAC meetings. Reports on sub-committee findings were provided to all committee members and are available for review.

6. On August 19, 1980, these sub-committees sponsored an "open house" meeting at Taos to seek further public input. This was advertised in the Taos News and announced on Station KKIT. A summary of the proceedings is available for review.

7. On September 16, 1980, there was a second public meeting at Taos, with the major emphasis on alternative types of facilities being considered. This was advertised in Albuquerque and Taos newspapers and Station KKIT. Again, attendance was large and public input was substantial. A major thrust of questions and statements was to oppose regional treatment alternatives, and to stress reliability and water supply as major issues. The Responsiveness Summary of this meeting is available for review.

8. A third public meeting was held on March 31, 1981, at Taos, with emphasis on the question of growth as affected by the size of a new facility. This was advertised in Albuquerque and Taos newspapers and Station KKIT. Questions and statements emphasized the desire for little or no growth in Twining in order to protect the environment of the Hondo Valley and the cultural traditions of the area. The Responsiveness Summary is available for review.

9. A recommendation from the CAC may be provided to the TWSD before formal selection of the type and size of a facility has been made by the Twining Water and Sanitation District Board. This may be a consensus recommendation if a consensus can be reached. If a consensus cannot be reached, it may take the form of majority and minority recommendations.

7.2 ISSUES AND THEIR DISPOSITION

Table 7-1 presents specific issues raised at the Scoping Meeting. Major areas of concern included: water quality of the Rio Hondo, water quantity and rights, socio-economic impacts on the Taos area, costs of proposed new facilities, and overall impacts of growth in Twining.

Certain areas of concern were raised at the Scoping Meeting which were addressed specifically by the State of New Mexico and EPA: legality of the District; eligibility for funding; lack of enforcement of the District's NPDES permit; and questions as to Forest Service responsibilities in water quality and growth management. The history of all four issues is discussed in Appendix A and summarized below.

Basically, the questions of legality and eligibility were resolved by the New Mexico Attorney General and EPA regional counsel, which found the District to be an appropriate recipient for EPA funding. EID agreed to take the lead in enforcement and negotiated an Assurance of Discontinuance with the District several months after the Scoping Meeting. The Assurance was successful in leading to improved facilities and water quality until early 1981, when aerator problems were encountered. Resolution of these problems is ongoing; section 5.4.8 discusses mechanisms for assuring active permit enforcement of the criteria.

The Forest service response to questions about water quality enforcement is discussed on page 5-42. Questions concerning growth due to TSV, Inc.'s, plans were addressed in the TSV master plan (Flance, 1980) and in a Forest Service EIS on the master plan (USFS, 1981a and 1981b), wherein a limit to growth of 4800 skiers was established (see section 6.6.3). In addition, the Forest Service is a cooperating agency for this EIS.

CAC Issues. Over the months that followed, additional issues were raised. Table 7-2 lists issues addressed by the CAC during their many meetings, and the response to them. The index also provides guidance in locating discussion of major issues.

7.3 ON-GOING COORDINATION

Table 7-3 lists agencies, organizations, and individuals with which coordination has been ongoing and/or which will have an opportunity to review the Draft EIS. The complete mailing list has not been reproduced here as it contains about 1,000 names. The list is available for review at depository A (see pg. 7-2).

EPA sent notices to those on the mailing list identifying the upcoming availability of this draft EIS. Recipients of the notice were asked to identify to EPA if they wished to receive a copy of either a summary or a complete draft EIS. Public notices of availability of this draft EIS and of a public hearing on this draft EIS and the related facilities plan will appear in the Federal Register and in various newspapers including the Taos News. The draft EIS will also be available for review at the following locations:

1. Harwood Foundation
   Public Library
   LeDuex Street
   Taos, New Mexico

2. Twining Water and Sanitation
   District Offices
   Above the Fire Station
   Taos Ski Valley, New Mexico

3. Taos Pueblo Administrative
   Offices
   Taos, New Mexico

4. Taos Ski Valley, Inc.
   Taos Ski Valley, New Mexico

5. Supervisor's Office
   Carson National Forest
   Cruz Alta Road
   Taos, New Mexico

6. New Mexico Environmental
   Improvement Division
   Taos County Health Building
   Paseo De Pueblo Sur
   Taos, New Mexico

7. New Mexico Environmental
   Improvement Division
   Crown Building
   725 Saint Michael's Drive
   Santa Fe, New Mexico

Copies of the summary of the draft EIS in both English and Spanish can be obtained from Jack Schact, Post Office Box 2956, Taos, New Mexico 87571, phone 505-758-3864; or from Clinton B. Spotts, Regional EIS Coordinator, U.S. Environmental Protection Agency, Region VI, 1201 Elm Street, Dallas, Texas 75270, phone 214-767-2717.

The draft facilities plan will be released at approximately the same time as the draft EIS and will be made available at each of the above seven locations. The public hearing on the draft EIS will be conducted jointly with TWSD and will encompass the draft facilities plan. Appendix E contains official letters received during the EIS preparation process; responses are provided as appropriate. These letters include: comments of Taos Pueblo; the U.S. Fish and Wildlife Service; the U.S. Army Corps of Engineers, and the State Historical Preservation Officer.

TABLE 7-1. ISSUES IDENTIFIED BY EPA AT THE SCOPING MEETING

A transcript of the meeting is on file at Depository A, listed on page 7-2.

I. Existing Situation

A. History of present treatment plant and associated problems (discharge violations, lack of proper operation and maintenance).
B. Legality of formation of the Twining Water and Sanitation District.
C. Eligibility of the Twining Water and Sanitation District for EPA funding under the Clean Water Act.
D. Government (both state and federal) enforcement of permits and regulations regarding treatment plant discharges. See Appendix A.4
E. Current effects of plant discharge on Rio Hondo water quality and possible health and other impacts on downstream residents.
F. Water consumption in the ski valley area.
G. Sludge disposal.
H. Non-point sources of pollution (septic tanks, agriculture, silviculture) both in the ski valley and downstream.
I Measures to reduce pollution on an interim basis.

II. Possible New Wastewater Treatment Facilities

A. Problems with infiltration and inflow to the current system.
B. Possible expansion of wastewater treatment facilities.
C. Operation and maintenance of any new facilities.
D. Costs of new facilities and related state and federal funding and parts B and C of chapter 5.
E. Future impacts of discharge from new facility on the Rio Hondo, including the possibility of future overloading.
F. Enforcement of permit and regulations relating to a new plant.
G. Water conservation.
H. Energy conservation.
I. Impacts of construction of a new facility. See Table 6-1.
J. Mitigative actions to be taken until a new system can be installed.
K. Impacts of non-point sources of pollution, both in the Ski Valley and downstream in the lower valley.

III. Other Issues

A. Delineation of area affected by project.
B. Effects of a new system on growth in Taos Ski Valley.
C. Possible changes in land use in Taos area.
D. Economic and social impacts
    1. Tax payments (direct and indirect) of ski valley
    2. Jobs and personal income generated by ski valley operation
    3. Changes to traditional lifestyle
    4. Increases in traffic.
E. Overall economic impact on Taos County [income versus expenditures, especially relating to government funds (local, state, federal) spent on schools, roads, police and fire protection, etc.].
F. Impact on water rights in ski valley and downstream.
G. Impacts on the uses of Carson National Forest and Wilderness Area, including recreation.
H. Impacts on the Taos Pueblo lands and activities (including religious ceremonies).
I. Changes in the Rio Hondo watershed (increased runoff, erosion, flooding, mudslides, and change in climate).
J. Possible changes in energy use, noise generation, air quality, etc.
K. Limitations to growth in the Twining Water and Sanitation District and Taos Ski Valley.

TABLE 7-2. ISSUES IDENTIFIED BY THE CITIZENS ADVISORY COMMITTEE

The CAC identified the following issues during its meetings.

1. Issue: What is the role and authority of this committee?
   Response: To gather public input and relay its findings in its advisory role to the District and indirectly to EPA and EID.
2. Issue: How were CAC members selected?
   Response: In accordance with EPA guidelines and with EPA approval.
3. Issue : What is the history and geographic limits of the TWSD?
   Response: A presentation was made by Charles Kleiner, member of the TWSD Board, and circulated to committee members through the minutes of the August 9, 1980 meeting of the Facilities sub-committee.
4. Issue: What are the existing facilities?
   Response: A field trip to the wastewater site and the ski slopes was sponsored by the Facilities sub-committee for all CAC members, on July 9, 1980.
5. Issue: What are the water resources available to the Rio Hondo watershed?
   Response: Information was provided the CAC through Lee Wilson & Associates, the NM Environmental Improvement Division, and the NM State Engineer.
6. Issue: What are the economic and cultural impacts of growth within the boundaries of the Twining District?
   Response: Information was provided by Lee Wilson & Associates, the Growth sub-committee, and a presentation by Sylvia Rodriguez, Taos native and professional anthropologist, listing what she considered to be the main concerns of the Hispanic residents of the area.
7. Issue: What are the possible types of alternative facilities to be considered?
   Response: The CAC and the Facilities sub-committee reviewed a total of 16 possible alternatives. In conjunction with committee technical advisors, the CAC reduced the list to six semi-final alternatives:
   - 1 - New Plant
   - 2 - Rehabilitation
   - 3 - Aquaculture
   - 4 - Compost toilets/ greywater treatment
   - 5 - Total recycling
   - 6 - Snowmaking
8. Issue: What are the various funding possibilities for plant construction and maintenance?
   Response: EPA and EID representatives presented various funding possibilities:
   A - Planning, design and construction, total eligible costs
      1 - U.S. Environmental Protection Agency 75%
      2 - State of New Mexico 12 1/2%
      3 - District 12 1/2%
   B - Operation and Maintenance
      Community 100%
9. Issue: What is the effect of skier traffic on the air quality of the area?
   Response: EID representatives assured the committee that no air quality standards are being violated.
10. Issue: What assurances are there that TWSD will comply with stream standards even with a new plant?
    Response: EID will continue current sampling program and use whatever mechanisms are required to assure compliance.
11. Issue: What should be the size of a new plant?
    Response: Of the several sizes included in the study, EID has stated that the maximum size in which it would participate in funding was 95,000 gpd.
12. Issue: Will the size of the treatment plant be an effective limit to growth?
    Response: Lee Wilson advised the committee that while a small plant might be a deterrent to growth, it would not be a controlling factor such as county zoning could be.
13. Issue: Who is ultimately responsible for control of both point and non-point source pollution in the District?
    Response: The Twining Water and Sanitation District is.
14. Issue: Would the industrial cost recovery concept apply to a new plant at Twining?
    Response: Congress repealed the industrial cost provision in October, 1980, according to Dave Neleigh, EPA.
15. Issue: Would a special tax or surcharge on users be feasible to generate revenue for the TWSD?
    Response: Special legislation to authorize this failed to pass in the 1981 NM legislature.
16. Issue: Do new stream standards now in effect downgrade the water quality of the Rio Hondo?
    Response: Dave Tague of NMEID assured the committee that there is no weakening of the criteria; they are just applied in a more reasonable way.
17. Issue: What will be the effect of a larger wastewater facility on the quantity of water available to downstream users?
    Response: Water quantity is largely a function of precipitation and upmountain vegetation, according to Forest Service hydrologists, with the sewer plant capacity having minimal effect.
18. Issue: Should CAC consultants conduct an in-depth house-to-house survey to determine the opinions of the area residents as to the socio-economic effects of TSV or the cultural values of the people?
    Response: Within the mandate of this particular EPA grant, this is not possible. A multi-dimensional analysis of this area-wide problem would more properly be the responsibility of the Taos County government.
19. Issue: What is the relationship between the U.S. Forest Service proposed Taos Ski Valley master development plan and this EIS?
    Response: The Forest Service plan deals only with federal land involved, while the EIS includes privately owned land as well.
20. Issue: What type of hookup policy should TWSD adopt?
    Response: Some type of phased expansion dependent on successful performance at flows which are initially set at existing levels.

TABLE 7-3. COORDINATION

Listed below are governmental or public-interest groups which will recieve a copy of the EIS; in addition over 900 other groups and individuals are being notified of the EIS's publication. An asterisk (*) indicates agencies or groups with which coordination took place during the planning process. A number of those notified have requested and will receive either a summary or a complete copy of the draft EIS.

Federal

* U.S. Forest Service, Carson National Forest
Farmers Home Administration
Soil Conservation Service
U.S. Dept. of Interior
U.S. Dept. of Commerce
U.S. Dept. of Transportation
Federal Aviation Admin.
Federal Highway Admin.
U.S. Dept. of Agriculture
Water Resources Council
Agriculture Stabilization and Conservation Service
U.S. Dept. of Energy
Federal Energy Regulatory Comm.
Advisory Council on Historic Preservation
U.S. Dept. of Housing and Urban Development
U.S. Public Health Service
U.S. Dept. of Health and Human Services
Heritage Conservation and Recreation Service
National Park Service, SW Region
Economic Development Admin.
U.S. Corps of Engineers
* U.S. Fish & Wildlife Service
Bureau of Indian Affairs
Bureau of Reclamation
U.S. Geological Survey (USGS)
* USGS, Water Resources Division
Indian Health Service
* Bureau of Land Management
Hon. Pete V. Domenici, U.S. Senator
Hon. Harrison Schmitt, U.S. Senator
Hon. Manuel Lujan Jr., U.S. Representative

State

* Environmental Improvement Division
State Health Agency
State Planning Officer
* Dept. of Game & Fish
* State Engineer
Parks & Recreation Commission
NM Dept. of Agriculture
* NM Travel and Tourism Division
* North Central New Mexico Economic Development Division
* State Highway Department
* NM Dept. of Health and Environment
Hon. Francisco Gonzales, Senator
Hon. Celestino Romero, Representative

Local
* Twining Water and Sanitation District
Taos Town Council
* Taos County Commission
Office of the Mayor, Taos
* Taos Pueblo

Public Interest Groups

* Committee to Save the Rio Hondo
* Hondo-Seco Development Assn.
Friends of Taos Valley
Taos Coordinating Council
Environmental Health Assn.
NM Citizens for Clean Air & Water
NM Wildlife Federation
NM Lung Assn.
NM Conservation Coordinating Council
Sierra Club
Wildlife Society
NM Wilderness Study Commission
Izaac Walton League
National Audubon Society
The Wilderness Society
Environmental Defense Fund
League of Women Voters
Ski New Mexico
Rocky Mtn. Ski Instructors
U.S. Ski Assn.
Taos County Merchants Assn.
* Taos Chamber of Commerce
Coronado Ski Club
NM Mountain Club, Inc.
NM Ski Areas Assn.
American Citizens Together

Other

Eight Northern Indian Pueblos Council
Red River Ski Area
* Taos Ski Valley
* MolyCorp

CHAPTER 8
LIST OF PREPARERS

8. LIST OF PREPARERS

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CHAPTER 9
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CHAPTER 10
GLOSSARY

10. GLOSSARY

Common Abbreviations

AF	Acre-feet
AFY	Acre-feet per year
BOD	Biochemical oxygen demand
CAC	Citizens Advisory Committee
cfs	Cubic feet per second
COD	Chemical oxygen demand
CWA	Clean Water Act
DO	Dissolved oxygen
EIB	Environmental Improvement Board
(NM)EID	(New Mexico) Environmental Improvement Division
EPA	Environmental Protection Agency (U.S.)
kwh	Kilowatt hours
mgd	Million gallons per day
mg/l	Milligrams per liter
NEPA	National Environmental Policy Act
NMWQCC	New Mexico Water Quality Control Commission
NPDES	National Pollutant Discharge Elimination System
OSS	On-site system
TCDWSA	Twining Cooperative Domestic Water and Sewer Association
TDS	Total dissolved solids
TOC	Total organic carbon
TSS	Total suspended solids
TSV, Inc.	Taos Ski Valley, Inc.
TSVWSD	Taos Ski Valley Water and Sanitation District
TWSD	Twining Water and Sanitation District
USFS	United States Forest Service
WRD	Water Resources Division

Acre-foot. 1 acre-foot is the amount of water which covers one acre to a depth of one foot.

Acre-foot per year. Equals 325,851 gallons or 43,560 cubic feet; this unit is used to quantify amounts of water rights.

Advanced secondary treatment. Treatment more stringent than secondary treatment but not to advanced waste treatment levels (see definitions of secondary treatment and advanced waste treatment).

Advanced waste treatment. Treatment providing for discharges with BOD and TSS of less than 10 mg/l (each) and/or total nitrogen removal of greater than 50 percent.

Aerobic/anaerobic microorganisms. Microorganisms that either thrive on air (aerobic) or do not (anaerobic). Aerobic bacteria are more efficient at consuming organic matter while anaerobic bacteria produce humus and gases, such as foul-smelling methane.

Aeration. The process which brings about contact between air and water by natural or mechanical means such as spray, bubbling, or agitation.

Aerated lagoon. A method of treating sewage by placing it into a lagoon and introducing mechanical aeration. The oxygen supports microorganisms feeding on the organic matter in the sewage, and at a more intense level than would occur naturally.

Basal area. The area occupied by timber in square-feet per acre.

Biochemical oxygen demand (BOD). The oxygen demand of a sample of water is the amount of elemental oxygen required to react with oxidizable or biodegradable material dissolved or suspended in the sample. When the agency through which the oxidation is affected is a population of bacteria, the oxygen required is called the biochemical oxygen demand (BOD). BOD tests are usually run for 5 days, hence BOD_5. BOD load is the pollutant content of a body of water, usually expressed in pounds of oxygen required to break down the pollutants.

Black wastes or blackwater. Waste from a toilet or urinal or garbage disposal.

Chemical oxygen demand (COD). (See BOD). A quick (and only approximate) measure of loads of oxidizable matter in water (in milligrams per liter) in which a strong oxidizing agent is used instead of microbial life. Like BOD, COD is an oxygen demand parameter; however, results cannot be used interchangeably with BOD values. COD can quickly identify water with very low or very high BOD potential.

Chlorination. The application of chlorine to water or wastewater, generally for the purpose of disinfection, but frequently for accomplishing chemical results, such as oxidation of odor-producing compounds.

Chlorine residual. Chlorine remaining in water or wastewater at the end of a specified contact period as combined or free chlorine.

Clarifiers. Mechanical devices for removal by gravity (settling out) of suspended particles in a liquid such as sewage.

Conductivity. The ability to carry an electrical charge, in ions. The conductivity of aqueous solutions is increased by dissolved salts and thus is a measure of the amount of ionized salts in solution.

Consumption. The amount of diversion of water not consumed, but returned back to the stream; also called discharge.

Cubic feet per second (cfs). Units used to measure flow at a gaging station; equals the rate of flow in a channel with a one-square-foot cross-section and velocity of one foot per second. One cfs for a 24-hour period equals 86,4000 cubic feet or 1.98 acre-feet.

Digester. In a wastewater treatment plant, a closed tank that decreases the volume of solids and stabilizes raw sludge by bacterial action.

Discharge volume. The quantity of liquid flowing per unit of time in a stream channel, conduit, or orifice at a given point.

Dissolved oxygen (DO). DO concentration of unpolluted water depends primarily on atmospheric pressure and temperature. Therefore, it is greater at sea level and when water is cool than at high altitudes or when water is warm. In the course of breaking down excess organic matter in water, microbes may deplete the oxygen causing stress from lack of oxygen on fish and other aquatic life. In extreme depletion, water may become anaerobic (literally without air) stagnate, and stink.

Diversions. The amount of water taken from a stream (or spring, well); also called withdrawals.

Effluent. Wastewater or other liquid, partially or completely treated, flowing out of a reservoir, basin, treatment plant, or part thereof.

Effluent limitation. Means any restriction established by a state or EPA on quantities, rates, and concentrations of chemical, physical, biological, and other constituents which are discharged from point sources into navigable waters, the waters of the contiguous zone, or the ocean.

Extended aeration. A method of treating sewage involving 24 hours of mechanical aeration in a tank to introduce oxygen and support anaerobic bacteria feeding on the organic matter in the sewage. In the subsequent settling stage, the mass of bacteria drop out to form a sludge. A portion of this "activated" sludge is recycled for treatment of fresh sewage.

Fecal Coliforms. A large and varied group of bacteria. The fecal coliform bacteria flourish in the intestines and feces of warm-blooded animals, including man. Escherichia coli (E. coli) is largely of fecal origin and has been the indicator organism most commonly cited as indicating sewage or feedlot pollution. The coliforms apparently do not themselves cause disease, but their presence in water suggests that disease-causing organisms (pathogens) may also be present. Coliform bacteria are used as indicators of pollution because they are abundant and their presence is fairly easy to detect. The coli-aerogenes group is also among indicator organisms and is not usually distinguished from other fecal coliforms. Enteric viruses are pathogens found in animal wastes. Methods for their identification in water remain provisional. The presence of fecal coliform bacteria suggests that pathogenic and viruses may be present--hence the concern over danger of bacterial infection whenever large numbers of fecal coliform bacteria are detected in water.

Greywater. Water-carried waste from the kitchen or bathroom sinks, showers, bathtubs, or washing machines; all household wastewater other than blackwater.

Grit. The heavier mineral matter, such as sand, gravel, etc., in water or sewage.

Groundwater. Subsurface water that completely fills (saturates) all available space within an aquifer and below the top of the zone of saturation. Groundwater does not occur in subsurface "lakes" nor move in subsurface "rivers" except those in a few caves in limestone.

Interceptor. Trunk line, usually at least 12" in diameter, which carries wastewater from smaller collection lines to the treatment plant.

Influent. Raw or partially treated wastewater flowing into a sewage treatment plant.

Milligrams per liter (mg/l). One part by weight of dissolved chemical, or suspended sediment, in 1 million parts by volume (= 1 liter) of water. See Part per million.

Million gallons per day (mgd). A unit of measurement for expressing the flow rate of sewage treated at a plant.

Monitoring. Periodic or continuous determination of the amount of pollutants present in the environment.

National Pollutant Discharge Elimination System (NPDES). Means the National permitting system authorized under section 402 of the Clean Water Act, including any state or interstate program which has been approved by the Administrator, in whole or in part, pursuant to Section 402.

Nitrogen. See Nutrient.

Non-point source. A type of pollution that cannot be pinpointed to a specific source. Pollution whose source is general rather than specific in location.

Nutrient. An element or compound required by an organism for growth and/or sustenance. Commonly, when referring to water quality, "nutrient" specifically means phosphorus and nitrogen.

On-site system (OSS). Individual facilities for treatment and disposal of wastewater, as opposed to a public wastewater treatment facility.

Oxidation lagoon. A process for the prolonged detention of sewage in shallow ponds. Natural (as opposed to mechanically induced) contact with air is designed to support aerobic microorganisms which digest sewage.

Part per million (ppm). One part by weight of dissolved chemical, or suspended sediment, in 1 million parts by weight of water. Roughly equivalent to milligrams per liter (mg/l) between 0 and about 7,000 ppm.

pH. Measure of hydrogen-ion activity in solution. Expressed on a scale of 0 (highly acid) to 14 (highly basic). pH 7.0 is a neutral solution, neither acid nor basic.

Phosphorus. See Nutrient.

Point source. Any discernible, confined and discrete conveyance, including but not limited to any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operations, or vessel or other floating craft, from which pollutants are or may be discharged.

Primary treatment. The physical treatment of sewage, such as by sedimentation (settling out of solid material), screening, etc.

Return flow. The amount of diversion water not consumed, but returned back to the stream; also called discharge.

Secondary treatment. Treatment level meeting effluent limitations for BOD and TSS of 30 mg/l (each) on a maximim monthly average basis. Secondary treatment removes virtually all floating and settleable solids and most BOD and TSS from the wastewater.

Septic wastewater. Wastewater in which material is undergoing decomposition under anaerobic conditions.

Settleable solids. The matter in wastewater which will not stay in suspension during a preselected settling period, such as one hour, but either settles to the bottom or floats to the top.

Sewage. A combination of liquid and water-carried wastes from residences, commercial buildings, industrial plants and/or institutions; wastewater.

Sludge. A concentrate in the form of a semi-liquid mass deposited as a result of the treatment of sewage.

Sulfate. The sulfate ion is one of the major anions occurring in natural waters. Sulfate has a laxative effect upon humans when it is present in excessive amounts. For this reason, the U.S. Public Health Service Standards recommend an upper limit of 250 mg/l in waters intended for human consumption. Waters containing appreciable amounts of sulfate tend to cause odor and corrosion problems.

Total dissolved solids (TDS). Theoretically, the anhydrous residues of the dissolved constituents in water. Actually, the term is defined by the method used in determination. In water and wastewater treatment, the Standards Methods tests are used.

Total organic carbon (TOC). A direct measure of carbon, which is the major constituent of organic matter. Unlike BOD and COD which are indirect measures of organic matter, TOC can be used successfully as an organic load parameter.

Total suspended solids (TSS). The sum of the solids which either float on the surface or are in suspension in water, wastewater, or other liquids, and which are largely removeable by laboratory filtering, usually stated in milligrams per liter.

Turbidity. Defined as capacity of material suspended in water to scatter light. Measured in arbitrary Jackson turbidity units (JTU) or, more recently, Formazin turbidity units (FTU). Highly turbid water is often called "muddy," although all manner of suspended particles contribute to turbidity.

Wastewater. The spent water of a community. A combination of liquid and water-carried wastes from residences, commercial buildings, industrial plants and/or institutions; sewage.

TABLE G.1. METRIC CONVERSION TABLE.

In keeping with U.S. Environmental Protection Agency policy, metric units are used in this report. These units may be converted to common English units by using the following conversion factors:

Metric Unit	Metric Name	Equivalent English Unit
	Length	
m	meter	39.3700 in.
m	meter	3.2810 ft.
cm	centimeter	0.394 in.
km	kilometer	0.6215 mi.
	Volume	
l	liters	0.2642 U.S. gal.
m^3	cubic meters	264.2 U.S. gal.
m^3	cubic meters	6.29 Barrels (BBL)
m^3	cubic meters	8.104×10^{-4} acre feet
	Weight	
kg	kilogram (10^3 grams)	2.2046 lb.
g	gram	0.002205 lb.
	Area	
h	hectare	2.471 acres
	Volumetric Flow	
m^3s	cubic meters per second	35.3 cubic feet per second
m^3s	cubic meters per second	22.8 million gallons per day
mg/l	milligrams per liter	1 part per million

Temperature

Temperature in degrees Celcius (^oC) can be converted to temperature in degrees Farenheit (^oF) by the following formula:

$$(^oF) = 1.8\ (^oC) + 32$$

APPENDIX A
EXISTING WASTEWATER MANAGEMENT

APPENDIX A. EXISTING WASTEWATER MANAGEMENT

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A.1 REGULATIONS AND PERMITS

The wastewater treatment system of the Twining Water and Sanitation District (TWSD) is operated under the conditions of: a) two permits, issued by the U.S. Environmental Protection Agency (EPA) and the U.S. Forest Service (USFS); b) an Administrative Order issued by EPA; c) the regulations of the New Mexico Water Quality Control Commission (NMWQCC); and d) an Assurance of Discontinuance negotiated between TWSD and EID. Details of all documents are provided in Table A-1. Two other permits have been issued to Taos Ski Valley, Inc. (TSV, Inc.) by the Forest Service. These permits do not affect TWSD directly but do address water quality above the TWSD treatment plant and are also summarized in Table A-1.

Forest Service Permits. Because the TWSD treatment plant is on National Forest Land it is subject to USFS regulatory control. However, it is the position of the Forest Service that EPA is the regulatory agency with respect to violations of water pollution regulations. Therefore the Region 3 Forest Service and EPA Region 6 have agreed that EPA should take the lead in enforcing any federal water quality requirements which apply to Twining. The Forest Service retains responsibility for overseeing stormwater runoff control from non-point sources, as discussed in USFS (1981a and 1981b) and chapter 6.2.2 of this EIS.

Surface Water Discharges. EPA's enforcement responsibility stems from the agency's administration of the Clean Water Act NPDES permitting system (see Glossary and section 3.2). The NPDES permit specifies terms and conditions which must be met by the effluent discharged from a sewage treatment plant (Table A-2). To check that the requirements are met, Twining must monitor the quality of its effluent discharge. Periodically, EID does independent monitoring; EID and EPA also inspect the plant to see if it is being operated and maintained properly. If conditions of the permit are not met (for example, effluent quality is worse than specified), EPA is empowered to take enforcement action against the permittee (in this case, the Twining Water and Sanitation District). Specifically, EPA can send a letter to the permittee citing the violations. The agency can also serve an Administrative Order on the permittee, which mandates certain actions by the permittee. Generally, specific actions are ordered, such as additions to the facility, hiring certified operators, or installation of water conservation devices. If the Administrative Order is not obeyed, EPA can go to court to obtain injunctive relief which would effectively require compliance with terms of the permit. The law also provides for fines of up to $10,000 per day for each day of non-compliance.

Although the State cannot enforce the NPDES permit, it can assume enforcement authority under state water quality regulations 30 days after EPA notifies the permittee of non-compliance and the permittee takes no remedial action. Enforcement actions can include an Assurance of Discontinuance of violations of State water quality regulations, which is a contract between the New Mexico Water Quality Control Commision (NMWQCC) and the permittee that the permittee will meet certain standards of performance. If these standards are not met, EID can seek an injunction or court-ordered action; fines up to $1000 per day can be imposed by the court.

Subsurface Discharges (On-site system regulations). EID also administers on-site system (OSS) regulations (EIB, 1979) which cover all systems receiving 2,000 gallons or less of liquid waste per day; systems discharging over 2,000 gallons per day require more thorough review by EID pursuant to state regulations controlling discharges to ground water.

A permit and inspection is required for all OSS installations and modifications. The permit can be denied if EID feels "the system is located, operated and maintained so as by itself or in combination with other sources, to potentially contaminate any drinking water supply, potentially pollute or cause high nutrient levels in any body of water, potentially degrade any recreational resource, create a nuisance, or cause a potential hazard to public health". The regulations forbid the installation or modification of cesspools, requiring instead (as a minimum) the installation of a dual-chambered septic tank with drainfield or seepage bed, or an acceptable alternative system.

Table A-3 includes key elements from the regulations describing the relationship between environmental conditions and lot sizes. Lots must be sized to allow for sufficient setback distances and to prevent the accumulation of nitrate in the ground water. Water with over 10 mg/l nitrate is believed by regulatory authorities to pose a health hazard to infants; large lots are required in an attempt to ensure that concentrations of on-sites do not overwhelm the ground water's ability to dilute nitrate to 10 mg/l.

A.2 EXISTING FACILITIES

The existing wastewater facilities at Twining are described in the draft facilities plan. This section contains only major points of importance to the evaluation of alternatives.

Collection and Treatment Facilities. Table A-4 summarizes information on the existing collection and treatment system and on-site systems in the area.

A.3 WASTEWATER CHARACTERISTICS

Treatment Plant Influent. There are no industrial users of the collection system. Average influent values are as follows (Leyendecker, 1980):

Temperature: 1°C (10°C without infiltration)
Biochemical oxygen demand (5 day): 200 mg/l
Chemical oxygen demand: 275 mg/l
Suspended solids: 150 mg/l
Total Kjeldahl nitrogen: 17 mg/l
Ammonia nitrogen: 17 mg/l
Phosphorus: 25 mg/l

Treatment Plant Effluent. Prior to June, 1974 there were no federal requirements placed on effluent quality at the Twining Plant (state limitations are given on Table A-2). NMEID sampled effluent quality on four occasions during this period; the results are listed in Table A-5, along with results gathered since 1974.

Table A-6 summarizes data concerning violations of the permit, compared to number of samples. The table divides the data into the ski season (November-April) and summer (May-October). Major conclusions reached from study of Tables A-5 and A-6 are: 1) the most common violations have been for biochemical oxygen demand, total suspended solids, fecal coliforms, and chlorine residual; 2) violations are more common in the ski season than in summer; 3) Twining and EID data disagree for chlorine residual; 4) the frequency of violations had not changed much in the last few years. Effluent quality was excellent during most of 1980, but mechanical problems led to permit violations again in late March and April 1981.

A new NPDES permit is expected to be issued in 1981, and will contain limits for biochemical oxygen demand (BOD_5), total suspended solids (TSS), pH, fecal coliform, chlorine residual, ammonia-nitrogen, and total phosphorus. Refer to Appendix B and Table 4-1 for a discussion of wasteload allocation and probable permit limitations.

Wastewater Characteristics of On-site Systems. Table A-7 characterizes the greywater and blackwater components of raw sewage and allows comparison of these to various stages and types of treatment (septic tank, drainfield, treatment plant). Septic tanks commonly reduce solids levels and oxygen demand levels by roughly fifty percent. Without disinfection, bacteria are found in quantities often exceeding millions per deciliter of water, and nutrients and metals are at levels only slightly less than found in raw sewage. Given a properly designed and installed drainfield and unsaturated soil conditions, most remaining pollutants will be removed by bacterial breakdown in the drainfield or by adsorption to soil particles. However, bacteria and viruses may surface or pass to the ground water if a drainfield is not working properly, and nitrate nitrogen is likely to pass through the soil unaffected regardless of system design. Phosphorus is normally considered to be completely removed by the soil, though exceptions may occur in areas of seasonal, high-water table and/or coarse soils.

Traditionally, contamination by bacteria has been the type of on-site system pollution emphasized by public health officials. However, epidemiologists are often hesitant to identify wastewater disposal as the specific cause of a disease pattern, due to the influences of other variables such as personal hygiene. Other types of pollution such as nitrate, dissolved solids, iron and manganese have been thought to result from on-site systems, though confirming on-sites as the source is difficult because impacts from agriculture or runoff from roads can be similar in nature.

Many studies have focused on nitrate pollution, as nitrate is especially mobile in soils and ground water. The significance of nitrate as a nutrient source in eutrophication (oxygen depletion of water) is well known; its public health significance is less clear. Some persons feel that fear of nitrates is exaggerated because the primary disease of concern affects infants only, is not fatal if attended to, and has been rare. However, other effects of nitrate poisoning may exist, such as physiological stress (EPA, 1977). Furthermore, the lack of reported nitrate poisoning cases may reflect inexperience and misdiagnosis.

A.4 MANAGEMENT AND ENFORCEMENT HISTORY

Table A-8 gives the chronology of wastewater management and permit enforcement at Twining, as summarized below.

Early developments at Twining utilized individual on-site systems from 1956 until 1966, at which time the Twining Cooperative Domestic Water and Sewer Association (the Association) was formed, obtained public funding, and (in 1967) built a wastewater treatment plant. In 1973 the Taos Ski Valley Water and Sanitation District (TSVWSD) was formed to provide eligibility for funding under Public Law 92-500. The procedure used by the District to annex the Association was found to be technically incorrect, but a second attempt was made in 1977, resulting in the present Twining Water and Sanitation District (TWSD). In 1981 the District absorbed the facilities and indebtedness of the Association, which was then dissolved.

In the meantime, the Association had been issued an NPDES permit (1974). Violations of the permit were numerous, resulting in EPA serving an Administrative Order on the Association in 1976. Association attempts to comply with the Order were unsuccessful. As a result, EPA and the State of New Mexico agreed that the State should exercise its power to enforce state water quality regulations. In 1979 the New Mexico Water Quality Control Commission (NMWQCC) and the District entered into an Assurance of Discontinuance whereby state regulations would be met. After extensive reworking of treatment facilities and operation and maintenance procedures, effluent quality improved considerably. However, problems with the surface aerator developed in the winter of 1980-1981, which resulted in two violations of the regulations. As a result of these violations, the NMWQCC filed a complaint, and a Judgment by Consent was made, whereby TWSD was required to pay a $500 penalty, expend $3,000 on plant improvements, and take weekly BOD and fecal coliform samples. Sample results can be used to enforce the terms of the Assurance, which remains in effect.

The Assurance was not intended to represent a permanent solution to wastewater problems in the TWSD; i.e., it will not enable the District to meet the strict long-term phosphorus requirements described in Table 4-1. However, it may be several years before a new plant is designed, built and in operation, and until then the existing treatment plant is required to meet existing effluent limitations.

TABLE A-1. PERMITS AND ORDERS IMPACTING THE TWSD.

1. United States Forest Service Special Use Permit, No. 4042, dated December 5, 1977. This permit is granted to the Twining Cooperative Domestic Water and Sewer Association (predecessor of TWSD) and is reviewed by the Forest Service on an annual basis. It covers 3.02 acres, the land with the treatment facilities. Major requirements of the permit are the following:

   a. The facility must comply with federal, state and local laws and regulations related to water and effluent quality.

   b. The facility must comply with applicable NPDES effluent requirements.

   c. The operator of the facility must be certified by the State.

   d. Each year the District must prepare an operation and maintenance plan for Forest Service review, setting forth in detail measures for complying with their NPDES permit.

2. United States Forest Service Term Special-Use Permit, No. 4035. The term permit was issued to the Taos Ski Valley, Inc. on June 30, 1976 for a 30-year period. It covers 36.17 acres of land around permanently installed facilities (ski lifts, tows, shelters, telephone communication system and support systems). The permit allows long term use and access to the facilities. The regulations address:

   a. care, upkeep and repair within permit area;

   b. protection of scenic and aesthetic values and prevention of pollution or deterioration of lands or waters within or adjacent to the permit area;

   c. safety and health regulations relating to fire protection, control and prevention, refuse disposal, and protection of stream quality in compliance with standards of local, state and federal authorities;

   d. construction standards, and conditions under which construction can commence;

   e. required lift inspection and maintenance;

   f. terms of payment and financial reporting;

   g. scope and authority of USFS with respect to compliance with other provisions of the permit.

3. United States Forest Service Special Use Permit, No. 2721, dated June 30, 1976. This permit was issued to Taos Ski Valley, Inc. and is reviewed annually by the Forest Service. It covers approximately 1044 acres used for ski slopes, trails and parking areas. This permit is issued for the purpose of clearing, grooming, and maintaining these areas. Provisions of the permit incorporate many of the Term Permit provisions and are substantially the same.

4. United States Environmental Protection Agency, Authorization to Discharge under the National Pollutant Discharge Elimination System (NPDES), No. NM 0022102, dated May 3, 1974. This permit authorizes and regulates the District's use of the Rio Hondo for elimination of pollutants. The permit expired in May, 1979, but its limitations are enforceable under the Administration Procedures Act until a new permit is granted. Its major provisions are:

   a. regulation of amount of discharge of sewage effluent into the Rio Hondo;

   b. limitations on the amount of pollutants allowed in sewage effluent;

   c. monitoring and reporting requirements related to effluent composition, frequency of monitoring and levels of discharge;

   d. provisions for state water pollution control agency (EID) to inspect District equipment, and records;

   e. provisions for non-compliance and compliance schedules and conditions.

   The effluent limitations contained in the permit are those normally applied to secondary treatment plants. The permit limits biological oxygen demand (BOD_5); total suspended solids (TSS); bacteria levels; pH; chlorine residual and flow. BOD is a measure of organic pollution, which may lower the dissolved oxygen levels in receiving streams to a point where aquatic animals will be killed. TSS measures potential effects on the clarity of a stream.

5. United States Environmental Protection Agency, Administrative Order, Docket Number VI-76-150, August 16, 1976. In response to violation of the NPDES permit, the order directed TWSD to take immediate action to efficiently operate and maintain its treatment facility and to avoid further non-compliance. After discussions with the Environmental Improvement Agency (now EID) the Forest Service and concerned citizens, the predecessor to TWSD agreed to:

   a. retain the services of a professional engineer to design plant modifications;

   b. require commercial users to install grease traps;

   c. continue to insist that surge flows be reduced;

   d. hire better trained personnel.

   The Association voluntarily imposed a hook-up moratorium, and took legal action to enforce the moratorium. The Association also ordered the installation of commercial grease traps, and made modifications to the system.

TABLE A-1 (CONTINUED)

6. New Mexico Water Quality Control Commission (NMWQCC), Assurance of Discontinuance, December 11, 1979. Despite the actions taken under the administrative order, and despite additional construction in 1977 (equalization basin, aerated sludge holding pond, chlorine contact chamber), NPDES violations continued. This led to enforcement actions by EID. The Assurance is an agreement between the TWSD and the Commission (through EID) describing certain steps the District must take to achieve certain levels of treatment (NPDES and State effluent limitations) by certain dates. By February 15, 1980, biochemical oxygen demand (BOD) in the effluent from the plant was not to exceed 60 mg/l more than once in 30 days, and fecal coliform bacteria were not to exceed 500 organisms per 100 ml at any time. By November 1, 1980, the effluent limitations to be met were 30 mg/l BOD, 500 fecal coliform per 100 ml; 125 mg/l COD (chemical oxygen demand), 0.5 mg/l settleable solids, and a pH of 6.6 to 8.6. The last four requirements are State effluent limitations (see Table A-4). Self-monitoring is required of the District by taking composite samples of BOD and fecal coliforms on either a Saturday or Sunday during each week of the ski season; results must be provided to EID within 30 days. If the District fails to comply with any of these provisions, NMWQCC retains the right to take appropriate legal action.

   Suggested improvements and resulting actions fell into four categories.

   a. Measures (such as water conservation) to reduce flows into the treatment plant, and thus reduce hydraulic overloading. Action: a flow meter was installed at the plant; additional low-flow fixtures were installed, as were water meters.

   b. Steps to reduce the amount of pollutants in the sewage which flows to the plant. Action: partially accomplished by item 1 above and by a continued ban on the use of phosphate detergents.

   c. Changes to improve the efficiency of the treatment plant itself. Action: the equalization basin was converted to an aeration basin; the package plant was converted to a clarifier (thus both aeration and clarifier capacities were increased).

   d. Improvement in the level of management and operation by the District. Action: the District developed an operation and maintenance manual for the remodeled plant; hired a bookkeeper and full-time certified operator; and increased the wastewater budget from $50,000 to more than $100,000 per year.

TABLE A-2. STATE OF NEW MEXICO AND NPDES TREATMENT PLANT EFFLUENT LIMITATIONS

Applicable effluent limitations for Twining prior to June, 1974, were those of the State of New Mexico, as derived from the New Mexico Water Quality Control Commissions stream standards (NMWQCC, 1981) and effluent regulations (NMWQCC, 1980). Since then, applicable standards have been as follows.

June 1974-Dec. 1976: "interim" NPDES limitations (see below).
Jan. 1977-Dec. 1979: "final" NPDES limitations (see below).
Dec. 11, 1979-Nov. 30, 1980: 60 BOD (under the authority of the Assurance of Discontinuance).
Dec. 1980-June 1, 1981: State limitations and final NPDES limitations, (under the authority of the Assurance of Discontinuance).

Since Dec. 1979, weekly self-monitoring has been required by the State, in addition to quarterly monitoring by EID for the NPDES permit.

kg = kilogram (1 kg = 2.2 lbs). mg/l = milligrams per liter (= one part per million). ml = milliliter.

PARAMETER & UNITS	STATE LIMITATIONS	NPDES LIMITATIONS					
		30-DAY AVERAGE		7-DAY AVERAGE			
		INTERIM	FINAL	INTERIM	FINAL	OTHER	MONITORING SCHEDULE
Biol. Oxygen Demand (mg/l)	30	60	30	60	45	-	once every three months
(kg/day)	-	6.8	3.4	-	-	-	
Total Susp. Solids (mg/l)	-	60	30	60	45	-	once every three months
(kg/day)	-	6.8	3.4	-	-	-	
Fecal Coliforms (colonies per 100 ml)	500	200	200	400	400	-	once every three months
pH	6.6-8.6	-	-	-	-	6.0-9.0	monthly
Chlorine Residual (mg/l)	-	-	-	-	-	0.01	twice per week
Settleable Solids (mg/l)	0.5	-	-	-	-	-	twice per week
Chemical Oxy. Demand (mg/l)	125	-	-	-	-	-	-
Flow or Discharge (gallons per day)	-	30,000	30,000	-	-	no more than 75,000 on any given day	once each day

*Note on BOD and TSS limits: EPA defines secondary treatment as that which results in an effluent quality of 30 mg/l BOD and 30 mg/l TSS (30/30). From surveys of existing effluent quality in New Mexico at the time that NPDES permits were issued, the EID felt that 60/60 would be a reasonable level for interim effluent quality, and that 2.5 years would be enough time to upgrade treatment plants so that they could meet the 30/30 standard.

Sources: NMWQCC, 1980; EPA, 1974

TABLE A-3. ON-SITE SYSTEM REGULATIONS: SITE CONDITIONS AND LOT SIZES.

The minimum lot size required is determined by the most limiting condition under which a soil characteristic falls. For example, if for a certain soil all site limitations were slight to moderate, except that the slope was over 25%, then either an alternative absorption field would be required or a holding tank or recycle system would be necessary. Where black water is confined to an enclosed system (composter, holding tank), required depth to ground water can be reduced by two feet and absorption field size can be reduced by forty percent.

SOIL LIMITATIONS	Slight	Moderate		Severe
Percolation rate (minutes/inch)	0 - 15	16 - 30	30 - 60	More than 60
Slope (feet/100 feet)	0 - 8	8 - 25	8 - 25	More than 25
Flooding potential (overflow frequency in years)	Less than 1 in 25			More than 1 in 25
Soil depth (depth of suitable soil below trench bottom in feet)	More than 4			Less than 4
Depth to seasonal water table in feet, from bottom of excavation (lot sizes less than 2.5 acres)	More than 10' (or 6' if documented)			Less than 10' (or 6' if documented)
Depth to seasonal water table in feet, from bottom of excavation (lot sizes over 2.5 acres)	More than 4'			Less than 4'

DESIGN FLOW (GPD)	Minimum Lot Size (Acres)			
Community water and on-site sewerage				
0 - 375	0.33	0.40	0.50	No conventional absorption field allowed (see below)
376 - 1000	0.50	0.75	1.00	
1000 - 1500	1.00	1.20	1.50	
1500 - 2000	1.25	1.50	2.00	
On-site water and on-site sewerage				
0 - 1000	0.75	1.00	1.25	No conventional absorption field allowed (see below)
1000 - 1500	1.25	1.60	2.50	
1500 - 2000	1.70	2.25	3.25	

LIMITING CHARACTERISTIC	Alternative Absorption Field Methods
Soil Depth --	Mounds or sand filters to maintain a suitable soil depth below trench or excavation bottom of at least four (4) feet.
Percolation Rate -- (between 60 - 120 min/in)	Alternating fields, seepage pits, deep trenches or beds. Pits or trenches can be used to get below a slow percolating soil. All systems shall prevent surface ponding.
Slope -- (between 25 - 50%)	Deep trenches or terracing which will not allow any sidewall seepage.
Seasonal Ground-Water Table--	Mounds or sand filters which allow compliance with the requirements for seasonal ground water table.

Source: adapted from EIB (1979).

TABLE A-4. DESCRIPTION OF EXISTING FACILITIES, TWINING, NEW MEXICO

Treatment Plant

Treatment facilities originally consisted of a 32,000 gallon per day package plant. An equalization basin (with diffusers) and chlorine contact chamber were added in 1977. In 1979, a surface aerator was added to the equalization basin and return sludge pumps were added to the aeration chamber of the package plant, thus converting the package plant into a clarifier. Modifications in 1980 included installation of pressure sand filters for effluent polishing, and improvements made to the chlorination system to increase detention time and frequency of chlorine feed.

At present the treatment plant consists of a manual bar screen for grit removal, an aeration basin which has potential for equalization of flows as well as removal of organic matter, clarifiers for settling of solids, pressure sand filters for effluent polishing, a hypochlorinator and two 1,000 gallon chlorine contact chambers connected in series, and an outfall line to the Rio Hondo. The facility has an aerated sludge pond for reduction of solids byproducts of the treatment process. There is no alternate power source available at the plant. Sampling of the effluent is performed regularly by TWSD. Daily records are kept by the operators; The District employs both a Class IV (highest rating) and a Class III operator certified by the State of New Mexico. Assistance is available for records keeping and management of the District's budget. The 1980 wastewater budget was $102,482.

Several major design inadequacies exist. Though the original package plant structure is in fair condition, its use as a clarifier is inadequate and inefficient in terms of size and shape. The headworks to the plant are too low in grade, causing backups during high flow periods. Disinfection time is insufficient due to the inadequacy of the two septic tanks now used as contact chambers. Disinfection using chlorine is questionable for a high-quality stream due to the potential for chlorine residuals and the need to eliminate such residuals at high cost. There are no existing facilities for phosphorus removal. The aerated sludge pond serves only a holding function and requires periodic removal to a disposal area near the Taos treatment plant. Treatment effectiveness has also been adversely influenced by the volume of sewage inflows, which in winter and spring may be greater than the design capacity of the plant. Were the infiltration problem to be resolved, it appears that the maximum flows experienced on busy weekends would be reduced from the vicinity of 100,000 gallons per day (gpd) at present, to very near 58,000 gpd.

Collection System

Existing sewage collection facilities consist of about 7,500 feet of vitrified clay pipe six to eight inches in diameter. There are twenty-one service connections, including thirteen commercial and nine residential; all but one of the major lodges/condominiums is connected. The collection system was examined in a preliminary infiltration/inflow study (I/I) in August, 1979, to estimate leakage of water into the system. Inflow of surface water during rainstorms was found to occur at several badly-built manholes, but calculations indicate that the amounts of water involved are relatively insignificant. However, infiltration of ground water through cracks or pipe joints is very significant. During the testing period infiltration amounted to two-thirds of the total flow into the treatment plant, or about 25,000 gallons per day. This is a rate well over twenty times the amount allowed by State regulations, indicating that the existing sewers are in very poor condition. This condition stems from poor installation in 1967, as well as ongoing problems of high ground water and frequent freeze-thaw cycles.

Recent Improvements

During the past two years, the following improvements have been made at the treatment plant.

1. Hired two certified operators, one to maintain all operations and one to run analytical lab (NPDES parameters and process control parameters).
2. Set up spare parts inventory and preventative maintenance systems.
3. Modified headworks hydraulics so that varied flows can be accommodated.
4. Ordered phase protectors for headworks and clarifier buildings.
5. Painted headworks, clarifier, and chlorine buildings.
6. Extensive repairs made on diffuser system in aeration basin.
7. Established system to monitor levels in aeration basin.
8. Insulation and heat tapes installed on the exterior piping of the waste-activated sludge and return activated sludge systems.
9. Purchased submersible pump for the purpose of cleaning contact chambers and detention tanks.
10. Improved process control monitoring system at the plant.
11. Improved chlorine system to prevent complications in winter.
12. Modified diffuser system in chlorine detention tanks.
13. Analyzed decant system and found improperly installed electrical network.
14. Sized and ordered water flow meters for commercial and residential establishments.
15. Conducted a review and compiled maps of water system.

TABLE A-4. (continued).

16. Increased the aeration system in the digester.

17. Modified the large clarifier to improve the hydraulics and thereby improve settling.

18. Purchased spare parts for aeration basin surface aerator.

19. Installed pressure sand filters to provide effluent polishing.

20. Repaired aeration basin (cracks, diffusers).

On-site Wastewater Systems

On-site systems (OSS) include all methods of wastewater disposal that do not discharge to a shared collection system leading to a public treatment plant. Although cesspools and privies are often used, the most common on-site system is the septic tank and drainfield. The septic tank is normally a metal, concrete or cinder block container, completely enclosed, and capable of holding 1000 gallons on the average. Household (or business) sewage drains via a pipe to the septic tank. The sewage is held in the tank long enough to allow solids to settle out; foam and grease float to the surface. Anaerobic (non-oxygen requiring) bacteria digest and reduce the bulk of the settled solids, which is termed septage. Grease and septage remain in the tank while the now relatively clear effluent enters the drainfield, which is a series of perforated pipes or open tile pipes buried in trenches or in a pit in the soil. Additional treatment by anaerobic bacteria occurs in the trench. The effluent from the drainfield percolates into the soil where remaining impurities are either filtered out physically, adsorbed onto soil particles, utilized by plants, neutralized by bacterial attack, or pass unchanged to the underlying ground water. Grease and septage must be removed from the tank every few years to prevent overflow and resulting drainfield failure.

The effectiveness of a typical drainfield depends on factors such as soil conditions, slope, depths to water table and bedrock, potential for flooding, lot sizes and setbacks. Soils should pass water (percolate) at a moderate rate. Slow, very fine-textured soils can result in saturated ground and sometimes surface ponding; ground that is saturated below the drainfield can reduce the effectiveness of pollutant removal. Fast, coarse soils do not provide adequate time for removal of pollutants. Steep slopes can result in lateral flows and surface seepage. Flooding and shallow depths to ground water or bedrock can also cause or aggravate soil saturation, ground-water pollution and/or surface seepage. Small lots may not allow for safe distances to wells, drainageways, foundations and the like. Specific drainfield conditions that must be met are described in Table A-3.

In urban areas, even where environmental conditions for on-sites are good, too many on-sites may result in saturation of soils or overwhelming of the ground water's ability to dilute pollutants that may pass through drainfields, such as nitrogen. Results can include surface and ground-water odors and degradation or contamination of shallow ground-water supplies.

Several types of OSS are used in the lower Rio Hondo Valley. Cesspools, and some privies, are likely to be common in the older communities of Arroyo Hondo and Valdez. Conventional septic tanks with drainfields probably make up less than one half of the systems in these communities. From the Forest Service boundary up to Twining, septic tanks are more prevalent, with a few holding tanks and privies (for seasonal cabins) in use as well.

The Twining Water and Sanitation District contains fifty-nine "cabins", only five of which are connected to the sewer system. Most cabins utilize septic tanks with drainfields. At least five cabins use holding tanks and one has an aeration tank. Kandahar condominiums use septic tanks with dry wells. An additional 94 building sites are available for cabins, and Taos Ski Valley plans to add a snack bar and "up-mountain" restaurant which would probably use an OSS.

Most future OSS are likely to be alternative systems due to environmental conditions (See Appendix B.5). The best building sites have been built on and remaining lots are located on either the Presa-Cryaquolls or the Marosa-Rock Outcrop soil associations. The former has slopes of 5 to 50 percent and is also likely to have groundwater within a few feet of the surface. Shallow ground-water results in saturated soils and an easily contaminated aquifer. The Marosa-Rock Outcrop has greater slopes, from 20 to 100 percent, and is likely to have bedrock near the surface; combined, the slope and bedrock can result in lateral flows and surfacing of wastewaters. Most remaining lot sizes are less than half an acre.

EID cannot designate whole areas as requiring alternative OSS, but must examine each permit request individually. However, the more recent OSS installations have been alternative systems, and as building sites become more difficult to build on, the trend towards requiring alternative OSS is likely to continue (Emmons, 1981). New condominiums will also be required to use alternative OSS unless they are willing to underwrite appropriate improvements in the District's treatment plant (EID, 1981a).

TABLE A-3. SUMMARY OF EFFLUENT QUALITY, 1973-1981, TWINING TREATMENT PLANT.

EID = based on EID sample data
Self = based on TWSD's self-monitoring sample data
lt = less than. tr = trace. mg/l = milligrams per liter. mgd = million gallons per day.

Parameter & Unit	1973a/ EID	1973a/ Self	1974 EID	1974 Self	1975 EID	1975 Self	1976 EID	1976 Self	1977 EID	1977 Self	1978 EID	1978 Self	1979 EID	1979 Self	1980 EID	1980 Self	1981 EID	1981 Se
Flow (mgd)	-	-	-	0.02	-	0.05	0.05	0.04	-	0.025	0.048	0.031	0.061	0.05	-	0.04	-	0.05
Biological Oxygen Demand (mg/l)	43	-	97.3	27.6	168	209.5	305	102.5	42	50	94	71	100	60.2	63.2	52.1	-	32.96
Total Suspended Solids (mg/l)	14	-	28.7	22.25	-	248.5	263	41.5	6.3	17	48	79	94.2	74.6	67.0	45.7	-	23.13
Fecal Coliformsb/ (no./100 ml)	-	-	-	0	7x10^4	3x10^4	6x10^4	7x10^5	-	1x10^4	693	3490	7	400	1x10^5	79e/	-	392.5
Chlorine residual (mg/l)	0.1	-	0.065	-	0.62	tr	1.2	lt 0.01	-	lt 0.01	1.6	lt 0.01	-	lt 0.01	0.18	lt 0.01	-	lt 0.01
pH	6.7	-	7.0	6.11	6.8	6.53	6.8	6.62	-	7.0	-	7.0	7.5	7.1	7.6	7.18	7.3	7.03
Settleable Solids (ml/l)	lt 0.1	-	lt 0.22	lt 0.1	2.0	0.7	-	2.2c/	-	0.1d/	-	0.8	3.8	-	-	-	-	-
Chemical Oxygen demand (mg/l)	145	-	131	-	110	-	569	-	90	33	209	-	271	-	185.1	-	-	62.5a/
Phosphate (mg/l as P)	3.3	-	2.8	-	-	-	-	-	-	-	-	-	6.3	-	6.6	-	-	4.2a/
Total Phosphorus (mg/l as P)	-	-	-	-	1.92	-	-	-	-	-	7.2	-	2.95	-	2.15	-	6.26	-
Nitrate (mg/l as N)	0.10	-	0.91	-	0.65	-	-	-	-	4.46	0.005	-	0.33	-	0.82f/	-	0.10f/	1.9a/
Ammonia Nitrogen (mg/l as N)	-	-	-	-	10.54	-	-	-	-	111	6.2	-	4.36	-	16.21	-	18.94	17.61a/
Total Kjeldahl Nitrogen (mg/l)	-	-	-	-	-	-	-	-		3.29	-	-	30.86	-	23.55	-	30.08	19.7a/
Total Nitrogen (mg/l)	13.3	-	15.06	-	15.85	-	-	-	-	3.29	41.8	-	25.1	-	-	-	-	-
Total Organic carbon (mg/l)	-	-	27.75	-	41	-	132	-	-	24	57	-	63	-	66.9	-	-	20.7a/
Temperature (°C)	15.8	-	8.6	-	7.8	-	3.3	-	-	-	-	-	5.63	-	9.24	-	6.0	-
Dissolved Oxygen (mg/l)	3.3	-	7.25	-	-	-	-	-	-	-	-	-	7.65	-	7.84	-	7.16	-

a. One sample
b. Expressed as powers of ten. E.g., 3x10^4 = 3x10x10x10x10 = 3x10,000 = 30,000.
c. April data was not included in the average, since the number of samples is unknown. The average April value was 0.67.
d. "Less than" values were averaged in as half the given value. For example, lt 0.1 would be averaged in as 0.05.
e. Average includes Dec. values of 2,300 & 440. Excluding these two measurements, average is 4.76.
f. Includes values for nitrite & nitrate. Nitrite is quickly oxidized to nitrate in the stream.
g. Influent BOD measured as 158 mg/l by grab sample.

TABLE A-6. PERMIT VIOLATIONS.

Table indicates the number of violations/number of samples. For example, 2/4 means that of four samples, two had excessive values. In some cases the self-monitoring reports give the month's average and maximum values, but are not clear as regards the number of samples which were in violation. "A" means that the average value for the month exceeded the permit limitations. "M" means that the maximum limitation was exceeded. NR means that no values were reported, though required by the permit.

SEASON [a]	FLOW	pH	SETTLEABLE SOLIDS [b]	CHLORINE RESIDUAL	BOD CONC.	TSS[b] CONC.	FECAL COLIFORM
SELF MONITORING:							
74 summer	0/?	2/4	0/?	NR	0/2	0/2	0/1
74-75 ski	A, M Dec-April	0/3	1/2	M, March	1/2	1/2	1/2
75 summer	A, M May, June	1/84	0/72	NR	0/2	0/2	1/2
75-76 ski	A, M Dec-April	0/?	A, M Dec-April	NR	2/2	1/2	2/2
76 summer	A, M May	0/157	A, M May-July, Sept.	1/19	0/2	0/2	0/2
76-77 ski	A, M Dec-March	0/161	A, M Dec, Jan	0/91	2/2	2/2	2/2
77 summer	M, Aug	0/178	A, M June	0/94	0/3	2/3	1/4
77-78 ski	A, M Feb-April	1/169	A, M Jan-March	0/57	4/5	4/5	3/3
78 summer [c]	A, May	0/?	NR	0/?	1/1	1/1	2/?
78-79 ski	A, M Dec-April	0/117	NR	0/54	2/3	3/3	0/2
79 summer	A, M May-July	0/68	NR	0/58	0/1	0/1	0/1
79-80 Ski	A, M Dec-April M, May & June	0/125	NR	0/40	23/27	26/27	3/21
80 summer	A, May-Aug	0/158	NR	0/63	0/20	0/19	0/17
80-81 Ski:[d]	A, Dec-Mar M, Jan-Mar	0/89	NR	0/24	5/13	4/15	5/13
EID COMPLIANCE MONITORING:							
74 winter	-	0/3	-	-	-	-	2/2
74 summer	-	0/5	-	1/1	-	-	1/2
74-75 ski	-	0/4	1/1	6/8	1/1	-	6/11
75 summer	-	0/6	-	5/5	0/1	-	3/7
75-76 ski	3/3	0/3	-	3/3	4/4	4/4	3/4
77-78 ski	2/2	-	-	4/4	2/2	1/2	2/4
78-79 ski	2/2	-	2/2	-	2/2	2/2	0/2
79-80 ski	1/1	0/2	-	6/8	10/10	9/10	7/9
80 summer	-	0/1	-	2/3	1/3	0/3	0/3
80-81 ski	1/1	0/1	-	-	1/3	2/3	-

---

a. "summer" = May through November. "ski" = December through April.
b. The permit requires monitoring for settleable solids, but does not set a limit on the value. Violations are based on New Mexico State standards.
c. No reports for July and August were available.
d. Does not include April.

TABLE A-7. POLLUTANT CHARACTERISTICS OF GREYWATER, BLACKWATER, ON-SITE SYSTEMS AND TREATMENT PLANTS.

Septic tank values are for tanks treating total waste stream, and for effluent directly from the tank. mg/l = milligrams/liter.

Source and Parameter	BOD5	Total Suspended Solids	Nitrogen T = Total NH_4 = Ammonia NO_3 = Nitrate TKN = Total Kjeldahl	Total Phosphorus
Greywater[a]				
% total waste stream	63	39	18 (T)	70
grams/capita/day	28.5	17.2	1.9 (T)	2.8
milligrams/liter	255	155	17 (T)	25
Blackwater[a]				
% total waste stream	37	61	82 (T)	30
grams/capita/day	16.7	27.0	8.7 (T)	1.2
milligrams/liter	280	450	145 (T)	20
Septic Tank Effluent				
milligrams/liter[b]	123	48	23.9 (T)	10.2
milligrams/liter[c]	140-175	45-65	50-60 (T)	10-30
Drainfield (mg/l) [c], [d]				
1 ft below trench	0	0	Background=60 (NH_4)	Background=10
3 ft below trench	0	0	Background (NH_4) Background=40 (NO_3)	Background
Conventional Secondary Treatment Plants[b] (design) (mg/l)	20-40	20-40	20-40 5-10	
Twining Plant g/l)[e]	8.4	11.9	19.7 (TKN)	4.2[f]

a. Siegrist, 1977.
b. EPA, 1980.
c. Hansel and Machmeier, 1980.
d. Assumes unsaturated flow. Also removed are fecal coliforms, viruses, heavy metals, and organic compounds; chlorides and nitrates may pass unaffected through coarse, aerated soils.
e. BOD_5 and total suspended solids are average effluent values for the last quarter of 1980; nitrogen and phosphorus values are from composite sampling by the Environmental Improvement Division, Jan. 14-15, 1981.
f. Phosphate as P.

TABLE A-8. CHRONOLOGY OF WASTEWATER MANAGEMENT AND ENFORCEMENT HISTORY

Oct., 1966	Twining Cooperative Domestic Water and Sewer Association formed.
1967-1968	The Association received an FmHA loan of $118,624 and a Federal Water Pollution Control Administration grant of $16,360 to construct a package sewage treatment plant; construction was completed in early 1968.
Jan., 1973	Taos Ski Valley, Inc., and Pattison Trust introduced a master plan for development of private land and additional ski facilities.
May, 1973	The Pattison family, which owns land in the area, filed a petition for the formation of the Taos Ski Valley Water and Sanitation District to serve a portion of the proposed development; a court order forming the District was issued the following January. To become eligible for funding under Public Law 92-500, TSVWSD sought to annex the Association. In response to a request from a State legislator, the New Mexico Attorney General issued a legal opinion with respect to the formation of the District and the annexation. The opinion stated that it was suitable to form a sanitation district which represented primarily commercial establishments, that the District was properly formed and that it would be eligible for federal funds. However, the Attorney General cited irregularities in the District's annexation procedure and the District never became an active organization.
May, 1974	The Association received an NPDES permit from EPA.
Aug., 1976	EPA served an Administrative Order on the Association mandating compliance with the NPDES permit, and suggesting installation of grease traps and reduction of surge flows. Steps toward compliance included construction of a large equalization basin and installation of a lift station, an aerobic digester and a chlorine contact chamber; a $35,000 loan was received from FmHA to fund construction, which was completed in 1977. TWSD also established a moratorium on hookups to the wastewater treatment system in an attempt to improve the situation. However, permit violations continued.
May, 1977	As a follow-up to the unsuccessful TSVWSD, the Twining Water and Sanitation District (the District) was formed. Questions were raised concerning possible irregularities in the formation of the District, but the Attorney General responded that both statutory and case law prohibit challenging the legality of a special district 30 days after it is formed.
Nov., 1978	An EPA memo dated November 21, 1978 states that the TWSD has the legal authority to carry out the functions required of a grantee under the construction grant regulations.
June, 1979	TWSD received a Step 1 Facilities Planning Grant from EPA, to plan new facilities.
Sept., 1979	EID informed TWSD of EID's intent to seek compliance with straight water quality regulations through legal action. Below is a summary of EID correspondence regarding operation and maintenance problems. 1. Lack of routine maintenance: continuously from 3/68 - 1/78. 2. Lack of trained operating personnel: continuously from 3/68 - 5/73. In 1973, the General Manager attended a training session. In Dec., 1979, Twining hired a certified operator. 3. Lack of a trained operator, maintenance schedule and records: continuously from 3/68 - 4/75. In May, 1975, Twining stated that such procedures had been put into effect. 4. Lack of basic lab equipment: continuously from 3/68 - 5/78. 5. Numerous operational problems, indicating lack of trained personnel, inadequate time commitment from operators: continuously from 3/68 - 2/77. In May, 1975, Twining responded to EID, implementing operational recommendations. 6. Failure to report results of tests on effluent: sporadically from 4/75 - 12/78. Twining submitted other monitoring reports on schedule. Subsequent letters more clearly defined water-quality goals and requested that TWSD enter into an Assurance of Discontinuance with the Water Quality Control Commission to meet specific effluent limitations in accordance with state water quality regulations.
Dec., 1979	The New Mexico Water Quality Control Commission approved the Assurance of Discontinuance between TWSD and EID to end violations of Section 2-101 of the New Mexico Water Quality Control Commission regulations.
1980	TWSD instituted the provisions of the Assurance, including flow reduction, reductions in the pollutant load, major structural/process alterations in the treatment plant, and hiring of full-time operator and records personnel.
Mar., 1980	EID files a complaint against TWSD in District Court because of violations of the Assurance. TWSD and EID agree to a stipulation that the complaint would be dropped if TWSD meets the Assurance between April 7 and May 15, 1980.
Apr., 1981	EID informs District it is out of compliance with Assurance.

APPENDIX B

INFORMATION RELATED TO SELECTION OF ALTERNATIVES

APPENDIX B. FACTORS RELATING TO SELECTION OF ALTERNATIVES

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B.1 TREATMENT OBJECTIVES

The evaluation of the alternatives was complicated because late in the planning period it was announced that regulations influencing treatment objectives were to be changed. In the final analysis all alternatives must be judged according to their ability to meet the proposed effluent standards listed in Table 4-1. The essential requirements are for conventional secondary treatment (reduction of organic matter and solids), advanced treatment to reduce phosphorus content, and disinfection to control bacteria.

However, when the facilities planning process began the state stream standards for high mountain streams were different than those listed in Table 4-1, and it was expected that any treatment plant in Twining would be required to reduce the total amount of nitrogen in the effluent. Subsequently it was proposed that the standards be amended to require control of phosphorus or nitrogen, depending on which nutrient is critical to improving river quality (see section 6.2.2). For the Rio Hondo, the New Mexico Environmental Improvement Division (EID) has determined that phosphorus is the critical nutrient affecting the river. Nitrogen removal is not likely to be required at a new facility (EID, 1981d).

Two major changes occurred in the analysis of alternatives in response to the elimination of a nitrogen-removal requirement.

1. Nitrogen treatment contributed to high dollar costs (energy, chemicals, personnel) for so-called 'conventional' processes. These high costs made it feasible to consider many otherwise exotic alternatives; in fact, many of the fifteen treatment alternatives were suggested only as a way of solving the nitrogen problem without all of the problems associated with conventional treatment. (Example: alternative 8 was conceived as a means of avoiding nitrogen treatment entirely, since it would convey Twining effluent along a 13-mile pipeline and discharge it to the Rio Grande, a less environmentally sensitive river than the Rio Hondo.) Elimination of the nitrogen-removal requirement led to revisions of and lower costs for the conventional alternatives, while most of the others were unchanged. Thus conventional treatment became much more cost-effective compared to most other options.

2. Because nitrogen removal is complex, the initial analysis cast substantial doubts as to whether or not many of the proposed options would work as intended and also indicated the potential for unreliable plant performance for most alternatives. Elimination of a nitrogen-removal requirement improved reliability ratings and enhanced confidence that any new facilities built by TWSD would work as intended.

Were nitrogen removal to be required at some time in the future, the selected alternative would have to be retrofitted with an anaerobic reactor, clarifier, methanol feed equipment, and heating for the aeration basin in order to attain nitrification. This would be expensive but capable of implementation. The likelihood of nitrogen removal being required in the future is considered low due to the degree to which the stream is phosphorus limited.

B.2 EQUALIZATION BASINS

During the planning process the State imposed the requirement that any treatment plant be designed to treat average sewage flows, not peak flows. Figure B-1 illustrates this concept. Peak flows (weekend) are stored in a tank (equalization basin) and treated during off-peak periods (mid-week). Plant capacity is set at the average flow for the entire week. There are two major 'cycles' of activity which could be used for design of an equalization basin. Figure B-1 reflects the weekly cycle, for which this approach is cost-effective. The other cycle - winter/summer - would require a basin sufficient to store most of the ski season flow for discharge in summer. This would require several acres of storage, which is not available in the area (see BLL, 1981).

B.3 DOLLAR COSTS

Dollar costs are contained in the draft facilities plan and summarized here in Tables B-1 and B-2. In each table there are five dollar values given, as follows.

A. Cost to build. This is the total price for design and construction of a facility. A portion of this amount could be eligible for EPA and EID funding.

B. Annual payment. The total cost is restated in terms of the annual payment. This is just like stating the total cost of a house in terms of the annual mortgage payment. The mortgage on a Twining plant is assumed to be paid off over 20 years, at 7.25 percent interest (these numbers are consistent with EPA regulations).

C. Annual cost of resources. This is the amount of money which Twining would be expected to pay for energy and chemicals to run a treatment plant and related facilities. This cost is not adjusted for inflation.

D. Annual cost of personnel. This is the expected amount of salaries and benefits paid to the technicians who would run the plant. This cost is not adjusted for inflation.

E. Total annual cost. This is the sum of items B, C and D. It represents the annual budget to pay the construction and operating costs of a new facility, in 1980 (uninflated) dollars. Note that some of this budget could be paid by grant funds.

The costs do not include any costs which Twining might have regarding the rest of the facilities in the Sanitation District, such as the cost of putting in new sewer lines or regulating septic tanks. The costs of water rights (which would be required by some alternatives) are also not included.

Table B-1 presents the initial cost estimates developed during the facilities planning process. For purposes of having a common basis for estimating costs, the plant was assumed to have a design flow of 112,000 gpd and to have no equalization basin. For discharge to the Rio Hondo, both nitrogen and phosphorus treatment were included.

As discussed in the text, design concepts shifted during the planning process; also, many alternatives were screened out. Table B-2 presents the second set of cost estimates developed during the facilities planning process. The costs reflect two design flows: 116,000 gpd (approximately the District's original goal); and 80,000 gpd (approximately existing flows). In both cases, flow equalization is included and there is no requirement for nitrogen removal. The engineering analysis of alternative 12 (rehabilitation) is ongoing as additional data on existing plant performance are developed; thus, the cost of this option may be adjusted in the final facilities plan (Leyendecker, 1981).

B.4 WASTELOAD ALLOCATIONS

This section explains EID's decision that a design flow of 95,000 gpd at a central treatment plant in Twining is consistent with 'acceptable' water-quality conditions (see also section B.2). Each of the factors which influences the flow calculation are reviewed; despite the use of numbers, these calculations are not precise. The calculations given below are based on the phosphorus standard. EID also did a wasteload allocation calculation for ammonia (EID, 1981d); from this it was determined that no treatment for ammonia removal was likely to be necessary. However, EID has proposed an effluent limitation of 30 mg/l total ammonia in order to assure that stream standards are met.

The Wasteload Allocation Equation. EID's equation for the wasteload allocation assumes that the design flow of a plant is known; using the flow and other information, EID then calculates the amount of phosphorus treatment which is required. The calculations described here apply to phosphorus, the critical pollutant in plant design and river protection. The equation can be rewritten so that if the amount of treatment is known, the maximum design flow can be determined. In the revised form, the equation is as follows:

$$Qe = \frac{Qa\,(Cs - Ca)}{Ce - Cs}$$

where: Qe = design discharge of treatment plant, in cubic feet per second (multiply by 646,316 to get gallons per day)

Qa = flow of stream at point that effluent discharge occurs, in cubic feet per second

Cs = stream standard for a given pollutant; the allowable maximum concentration, in milligrams per liter

Ca = existing or projected concentration of pollutant in stream above treatment plant discharge, in milligrams per liter

Ce = concentration of pollutant in treatment plant effluent, in milligrams per liter.

In this appendix, values are given for each of the above variables: Qa = 3.3 cfs; Cs = 0.1 mg/l; Ca = 0.06 mg/l; Ce = 1.0 mg/l. Based on these values the equation can be solved as follows.

$$Qe = \frac{3.3\ (0.1 - 0.06)}{1 - 0.1} = \frac{0.13}{0.9}$$

$$= 0.1467 \text{ cfs}$$

$$\times\ 646{,}316 = 94{,}793 \text{ gallons per day, or about } 95{,}000 \text{ gpd.}$$

Allowing for infiltration, this indicates that the average sewage flow from all hookups should not exceed about 95,000 gpd during the peak week of the ski season. As discussed subsequently, this capacity can be exceeded by the District in the future if certain conditions are met. However, as a maximum design flow, the value of 95,000 gpd is appropriate. As stated above, EID's approach is to assume the flow as known, then calculate the necessary phosphorus removal. A flow of 100,000 gpd would require phosphorus removal to 0.95 mg/l, which rounds to 1.0 mg/l. Therefore, EID feels that a 100,000 gpd plant is acceptable.

The next sections of this appendix discuss each of the parameters used in the equation.

Qa. EID has determined that the stream discharge used in the wasteload allocation shall be the lowest seven-day flow expected in a ten-year period. This is more conservative than the normal approach, which uses the two-year seven-day low flow. The value of Qa at Twining was calculated by Louis Reiland, a retired USGS hydrologist, who is New Mexico's expert on this subject. He used the long gaging station record at Valdez to estimate variations in flows in the Rio Hondo, and used four specific measurements made at Twining to correlate flows there with those at Valdez. His results were as follows:

Month	10-Year 7-Day Low-Flow (cfs)
January	3.57
February	3.53
March	3.99
April	5.60
May	11.2
June	11.4
July	7.3
August	6.57
September	5.35
October	4.87
November	3.60
December	3.58

For water-quality purposes, the February flow is the lowest and therefore the most critical.

These values of Qa could be in error on three counts. First, the flow data for Valdez include conditions from the relatively wet 1930's and 40's as well as the relatively dry 1960's and 70's; if only the later (more typical?) years were used, the low-flow might be less. Second, the Valdez data are extrapolated to Twining on the basis of only four measurements; at best the extrapolation is imprecise. Third, even if Qa = 3.53 cfs today, increased water use in Twining could reduce stream flows in the future.

Regarding whether or not the data are biased because both wet and dry periods are involved, EID has recalculated Qa using Reiland's procedures but only flow data since the early 1950's drought. This has resulted in a revision of Qa to 3 5 cfs. This low flow might be experienced in any of the months from November to March in the driest year of ten years.

Regarding Reiland's procedures and the validity of his extrapolations, these can be verified only if a gaging station is established in Twining and measurements are made at both Twining and Valdez over a period of years and a range of flows. A review of Reiland's report suggests that his correlation conforms to acceptable practices. Moreover, since his report was completed, USGS has revised its estimates of flow at Valdez on the four days that measurements were made in Twining. If these revised flows were used, Reiland's estimates of flow at Twining would be increased by as much as 10 percent. Thus, Qa = 3.7 cfs. This indicates that EID's current intention to use 3.3 cfs is very conservative. However, on April 1, 1981, EID measured a flow of 3.8 cfs at HON4 (right above the treatment plant). This is an unexpectedly low flow for the time of year, and demonstrates the value of using conservative figures.

Finally, growth in water use in Twining may require the transfer of water rights from the lower valley. The State Engineer will require a transfer which is sufficient to offset any effects on flows at Arroyo Hondo. Thus for the basin as a whole, there would be no change in river discharge. However, there would be changes in the timing of water use and also in the point of use. In particular, if Twining increases its water use considerably in winter, then in the vicinity of the treatment plant discharge the stream flow in the winter season could be reduced, even if there were no reduction in flow at Arroyo Hondo for the year as a whole.

In summary, Qa is estimated to be 3.3 cfs, a value which appears to be very conservative for existing conditions. Quite possibly, installation of a gaging station in Twining would lead to an eventual recalculation of this number, and a higher value. On the other hand, any transfers of water rights could lower the number. Ongoing surveillance of the situation is needed.

Cs. Cs is set by State regulation. For phosphorus, Cs = 0.1 mg/l. Questions have been raised as to whether Twining should be allowed to discharge pollutants such that Cs may be reached at Twining, or if instead, some of the dilution capacity of the river should be reserved for the benefit of downstream users. This subject is discussed in Appendix C.7.

Ca. At present the background level of phosphorus (natural sources, fertilizer, septic tanks, fertilizers) is such that above the treatment plant total phosphorus is typically less than 0.03 mg/l, or 30 percent of the stream standard. EID assumed that with future development (for example, more septic tanks) this value would double, and therefore used 0.06 mg/l in its initial wasteload allocation.

To test EID's assumption, a series of calculations was made to 'explain' the existing concentration of phosphorus above the plant, and then these calculations were then extended to future conditions for the 'maximum' projected development of the area. The calculations are summarized in Appendix C.6.

Stated simply, it appears that natural runoff, on-site systems, fertilizer use and runoff from the developed base area are more or less equally important today and account for virtually all of the phosphorus in the river above the plant. Large scale future development could lead to very large increases in non-point phosphorus loadings, possibly to levels more than twice 0.06 mg/l. On the other hand, were effective control techniques used (such as by control and treatment of parking lot runoff, more advanced types of on-site systems) then the non-point phosphorus load could decrease dramatically compared to current conditions.

On balance, EID's prediction that background phosphorus will double is a conservative conclusion, especially if the level of growth is that associated with a 95,000 gpd plant. Clearly, the loadings will need to be reviewed if larger growth occurs, to determine whether or not water-quality problems are likely to result. For now, Ca = 0.06 mg/l appears to be an appropriate value.

Ce. This is the most uncertain value in the calculations. Well-run plants of the type proposed by alternatives 1, 2, and 12 reliably achieve 0.4 mg/l or less total phosphorus in the effluent. With 'ordinary' operation, the processes will produce an effluent containing 0.5 mg/l phosphorus or less on the average, and 0.9 mg/l or less at least 90 percent of the time. EID has calculated a value of 1.0 mg/l, which assumes that the plant may not be operated particularly well (as has been the case in the past). The level of operation needed to accomplish such treatment can be achieved through enforcement of the NPDES permit.

Ultimate capacity. The many uncertainties and basically conservative nature of the wasteload allocations is an indication that the District could someday expand beyond a 95,000 gpd flow. The ultimate flow depends on the values used in the equation. As a matter of prudence the District would be expected to collect evidence that the input number can be changed before enlarging the facility and discharge. (Any other approval would run the risk of violating the stream standards).

To illustrate the effect of just one of the factors, consider that Ce could be 0.4 mg/l or less, on a reliable basis. If so, and if the other parameters in the equation are unchanged, then a capacity of over 200,000 gpd might be possible.

Seasonal Variation. The proposed permit (Table 4-1) allows Ce to increase in spring (Qa is large) and summer (when Qe is low). The purpose is to reduce the costs and resource use of wastewater treatment when such treatment is not needed to protect the river. If Qe in late summer were to increase well beyond existing levels, the permit as stated would not ensure protection of the Rio Hondo and would require revision.

B.5 ON-SITE SYSTEM ALTERNATIVES

Alternatives to the conventional septic tank/drainfield, and some of their advantages and disadvantages, are listed in Table B-3. Alternatives either 1) reduce the strength or amount of wastewater, e.g., commode alternatives, 2) facilitate its disposal, e.g., drainfield alternatives, or 3) eliminate on-site disposal altogether, e.g., total recyclers and holding tanks.

Reducing the pollutant strength of wastewater also facilitates disposal. Wastewater that no longer contains wastes from toilets and garbage disposals is termed greywater; the toilet and garbage disposal wastes are termed blackwater. Where blackwaters have been removed, substantial reductions in depth to ground water and drainfield size are allowed (see Table A-3). Thus the use of composting toilets, for example, makes possible the installation of (and reduces the cost of) the septic tank and drainfield on lots that have inherent setback problems, such as depth to ground water or problems caused by the arrangement of buildings or watercourses on a lot.

TABLE B-1. COST OF FIFTEEN TREATMENT ALTERNATIVES

See page B-4 for explanation of cost estimates.

Alternative number, name	Cost to to build	Annual payment	Annual cost of resources	Annual cost of personnel	Total annual cost
1. New plant	$1,107,000	$106,554	$21,600	$57,500	$185,654
2. Aquaculture	$ 854,252	$ 82,226	$ 9,146	$22,500	$113,872
3. Septic tanks	$ 560,000	$ 53,902	$22,400	$10,000	$ 86,302
4. Grey/blackwater	$1,780,000	$171,334	$73,118	$22,500	$266,952
5. Storage, discharge	$ 529,724	$ 50,988	$ 5,679	$22,500	$ 81,167
6. Total detention	$4,747,306	$456,952	$ 9,146	$22,500	$488,598
7. Land application	$2,305,300	$221,897	$ 6,400	$35,000	$263,297
8. Pipeline to Rio Grande	$1,914,670	$184,296	$ 7,681	$22,500	$214,477
9. Holding tanks	$ 347,720	$ 33,470	$74,558	$35,000	$143,028
10. Hondo regional plant	$2,020,000	$194,435	$ 9,000	$22,500	$226,235
11. Taos regional plant	$2,188,967	$210,699	$20,600	$22,500	$253,799
12. Rehabilition	$ 616,700	$ 59,203	$16,983	$57,500	$133,686
13. Total recycling	$2,154,000	$206,784	$62,101	$68,750	$337,635
14. Greywater evaporation	$4,066,400	$390,374	$51,000	$45,000	$486,374
15. Aquaculture + snowmaking	$1,251,976	$120,190	$ 11,646	$ 33,750	$165,586

TABLE B-2. COST OF SIX SEMIFINAL ALTERNATIVES

Capacity: 116,000 GPD

Alternative number, name	Cost to build	Annual payment	Annual cost of resources	Annual cost of personnel	Total annual cost
1. New plant	$ 887,140	$ 85,422	$ 18,720	$46,250	$150,392 a/
12. Rehabilitation	$ 608,870	$ 58,628	$ 13,900	$46,250	$118,778
2. Aquaculture	$1,009,622	$ 97,216	$ 9,500	$22,500	$129,216
4. Compost toilets/ greywater treat.	$2,350,000	$226,281	$113,500	$35,000	$374,781
13. Total recycling	$2,361,360	$227,375	$ 64,585	$68,750	$360,710
15A. Snowmaking	$ 413,633	$ 39,829	$ 2,600	$11,250	$ 53,679

Capacity: 80,000 GPD

Alternative number, name	Cost to build	Annual payment	Annual cost of resources	Annual cost of personnel	Total annual cost
1. Advanced plant	$ 612,127	$ 58,942	$ 12,420	$46,250	$117,612
12. Rehabilitation	$ 571,298	$ 55,010	$ 9,591	$46,250	$110,851
2. Aquaculture	$ 696,638	$ 67,079	$ 6,555	$22,500	$ 96,134
4. Compost toilets etc.	$1,680,000	$161,767	$ 78,450	$35,000	$275,217
13. Total recycling	$1,629,338	$156,889	$ 44,426	$68,750	$270,065
15A. Snowmaking	$ 285,408	$ 27,482	$ 1,794	$11,250	$ 40,526

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a. For comparison purposes, a plant of this size which accomplishes nitrogen removal would increase costs to $202,076 per year.

TABLE B-3. ALTERNATIVE METHODS OF ON-SITE DISPOSAL AND TREATMENT.

Alternatives	Description	Advantages/Disadvantages
Commode Alternatives		
Digesting Toilet	Micro-organisms digest wastes aerobically. Hand pump uses effluent for flush. Small outflow of clear-effluent.	ADV: Uses no water; produces little effluent. DISADV: Requires small amount of electricity (approx. $1/month) and weekly addition of microorganism cultures ($1/month); odor potential
Incinerator Toilet	Wastes are incinerated in timed cycle after each use. Ash must be removed periodically. $500-$1000/unit. Used for vacation homes.	ADV: Uses no water; produces no liquid waste. Easily retrofit. DISADV: Uses energy (1/4 lb. gas or 0.08 kwh per cycle). May require use of paper bowl liner after each use.
Composting Toilet	Garbage and human wastes are digested by naturally occuring microorganisms, producing fertilizer. $1000-$2000/unit, or can be home-made. Yearround use.	ADV: Uses no water; produces no liquid waste. DISADV: May require ventilating fan (110 AC, 20 to 46 W, 1-8 kWh/d; some models require heating elements (e.g. 110V - 160W); odor potential
Recycling Toilets	The flush liquid (oil or water) is recycled for further flushing use after filtration, separation, and/or aeration. Wastes are stored in a holding tank.	ADV: Uses little or no water. DISADV: Requires hand pump or power for flushing.
Privies	Wastes collect in a pit which is covered with soil when nearly full.	ADV: Low cost; uses no water. DISADV: Must be moved periodically; potential for odor, flies.
Treatment Alternatives		
Aeration Tank	Resembles septic tanks but air is introduced mechanically to support aerobic decomposition. Wastes go to a normal drainfield.	ADV: May improve some aspects of effluent quality. DISADV: Greater capital, operation and maintenance costs than for septic tanks; no reductions in volume or nutrient levels of wastewater.
Recycle Systems	All wastewater is treated to drinking water standards by physical, biological and chemical processes contained in a large (septic tank-sized) tank.	ADV: No other treatment of wastewater is required; minimal water use. DISADV: Energy and chemical costs and usage; operation and maintenance requirements.
Holding Tank	All wastewater is held in a large tank for periodic removal by pumper truck.	ADV: No on-lot discharge thus suitable to any lot. DISADV: Ultimate disposal and treatment still required.
Absorption Field Alternatives		
Wide or deep trenches, seepage pits, alternating fields	Unusually wide or deep trenches or a pit without trenches, or two fields used alternately by season or year.	Wide trenches, seepage pits and alternating fields are used to get below or overcome a slow percolating (tight) soil. Deep trenches are used to prevent sidewall seepage on slopes.
Sand mounds or sand filters	Sand-filled trenches (sand filters or above ground sand beds (filters and mounds).	Pretreats wastewater before discharge to shallow soils, high water table or tight soils.
Evapotranspiration fields	Sand and earth-filled beds lined at the sides and bottoms; utilizes only evaporation and transpiration by plants.	ADV: Eliminates discharges to ground water. DISADV: Wastes water; unsuitable for rugged, cold or wet areas.

Sources: EPA, 1980; EPA, 1980a.

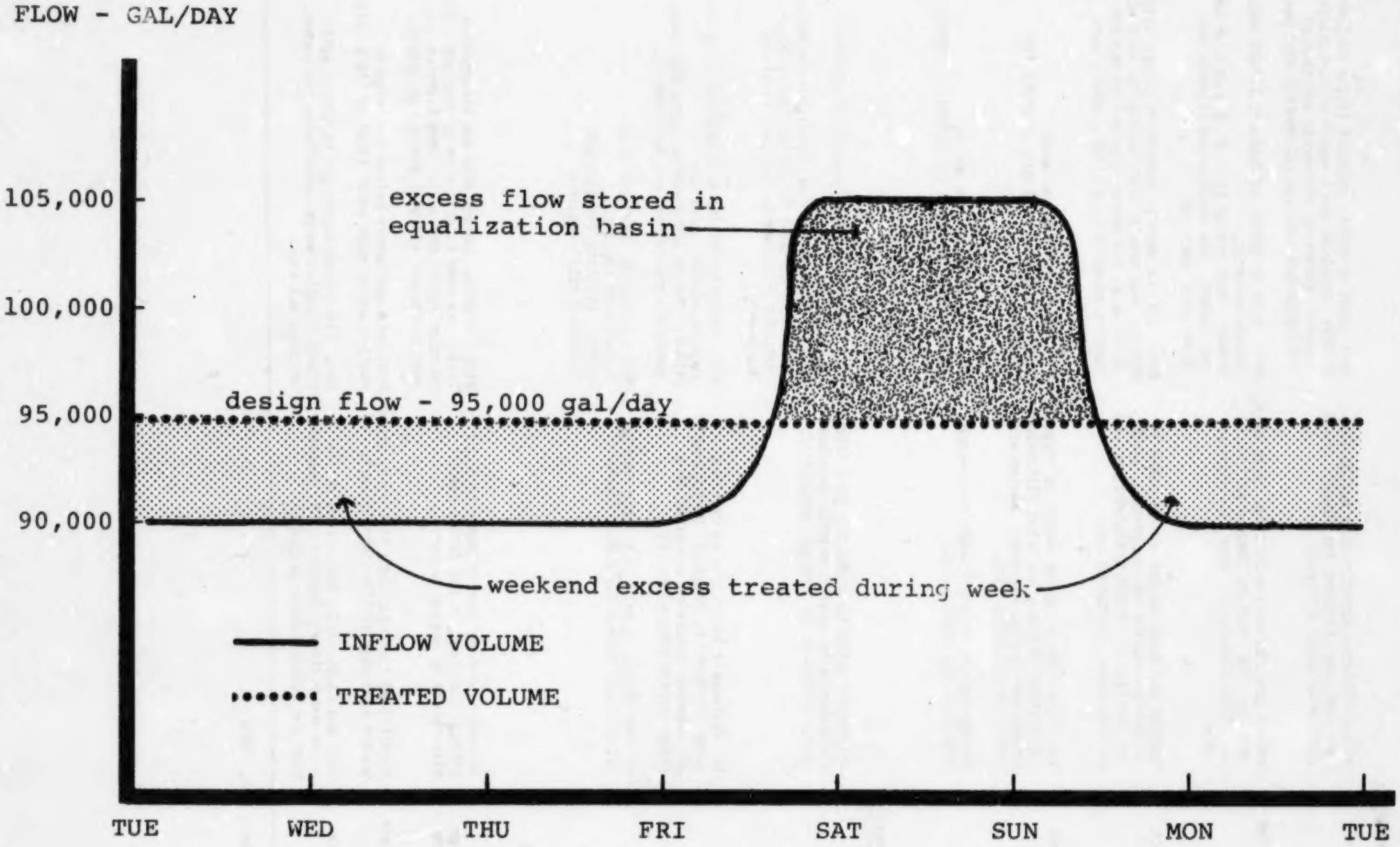

Figure B-1. Effect of Equalization Basin on Design Capacity.

APPENDIX C
WATER RESOURCE ISSUES AND DATA

APPENDIX C. WATER QUANTITY AND QUALITY

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C.1 GAGING STATION RECORDS

The U.S. Geological Survey has operated three gaging stations in the Rio Hondo Drainage Basin, as follows.

Rio Hondo near Valdez. Station 08-2675; drainage area 36.2 square miles; operated 1934-present. Average flow = 25,650 acre-feet per year or 13.3 inches. Records poor/fair for winter. Table C-1 summarizes the extensive flow data available at this station.

Rio Hondo at Valdez. Station 08-2680; drainage area 38 square miles; operated 1916-1934.

Rio Hondo at Arroyo Hondo. Station 08-2685; drainage area 65.6 square miles; operated 1910-present. Average flow = 20,000 acre-feet per year or 4.03 inches; reflects considerable upstream diversions and use of water for irrigation. A table similar to C-1 is available for this station in the files of Lee Wilson and Associates, PO Box 931, Santa Fe NM.

C.2 CAUSES OF DECLINE IN RUNOFF

Section 6.2.1 identifies a major environmental problem in the Rio Hondo watershed - a 25 to 40 percent reduction in runoff in the last 20-30 years. This problem was extensively analyzed by Claassen and Anderson in Wilson (1980, Chapter IV) and in the Forest Service EIS on Taos Ski Valley's master plan (USFS, 1981a and 1981b). Except as noted, the discussion which follows is taken directly from the work of Claassen and Anderson, as presented in Wilson (1980, Chapter V).

1. Chance. Runoff is naturally variable and some of the decline could be the result of random chance. A statistical test (rank-sum test) compared flows in the period 1943-1958 (Time I) to flows in the period 1959-1978 (Time II). The average annual runoff for Time I was 8,762 cfs, for Time II it was 6,162 cfs, a reduction of 30 percent. The test indicated that, at a confidence level of 98 percent, the difference between the two periods is "real", that is, the difference is caused by factors other than random fluctuations. Additional testing determined that spring runoff (March through June) is significantly different between the two periods, whereas summer (July through October) and winter (November through February) runoff is not. A second type of test (student-t test on least squares regression line) confirmed that flows in Time II are significantly less than for Time I.

2. Climate. Several studies of long-term climate change in the western U.S. suggest that the the early part of the twentieth century was characterized by a period of anomalously high runoff, whereas the drought which began in the 1950's may be as severe as any which has occurred in the last 250 or more years. Wilson (1978) showed that there had been a decline in total precipitation in Taos County from 1940 to the present, although there was a reversal of the trend in the mid-1950's. The decline in runoff parallels the

precipitation decline until the 1950's; the improved supply of precipitation since then has not been matched by an increase in stream flow. Thus total precipitation alone cannot account for the change in runoff.

Analysis of other climatic factors suggests that there is no clear explanation of the decline in flow. Factors such as a reduction in snowpack moisture content, the timing of precipitation events, and temperature do correlate to varying degrees with changes in runoff (as determined by least-squares and correlation analysis). The data suggest that while total precipitation may have increased significantly since 1960, increases in winter precipitation have been rather small. This could partially explain why spring runoff (snowmelt) has not recovered to pre-1960 levels. However, Wilson (1980) concluded on balance that climate could explain some but by no means all of the observed runoff trend.

3. Vegetation (Forest Management). The size and density of forest within a watershed has a significant impact on runoff, because of the large amounts of water used by vegetation for evapotranspiration. Vegetative growth is limited by fires, pests (e.g. budworm), and timber harvesting. In the Carson National Forest, management practices directed toward protection of the trees have restricted the limiting factors, thus promoting forest growth and leading to a decrease in runoff (but probably improving water quality).

USFS (1981a and 1981b) estimated this effect for the Rio Hondo watershed where there is almost no cutting (except for the ski trails at Taos Ski Valley) and there have been no major forest fires for 90 years or more. Vegetative growth in the watershed, as measured by basal area, increased by 23 percent from 1963 to 1974. This would account for an increase of one to one and one half inches of water lost to evapotranspiration each year, or virtually all of the decrease in Rio Hondo runoff.

4. Water Use in Twining or Elsewhere. As discussed in section 6.2.4, consumptive water use in TWSD and vicinity is small. Even with inflation of the numbers given in the text, this use could account for no more than 1 percent of the 6000+ acre-feet reduction in runoff at Valdez. Effects at Arroyo Hondo would be less, as most of the TWSD use has been offset by retirement of lower valley water rights.

The conclusion that the change is not related to resort development is supported by studies which show that patterns virtually identical to Figure 6-3 occur for nearly every stream in Taos County, and specifically: Rio Lucero, Rio Pueblo, Rio Grande (near Lobatos, Colorado and at Embudo), Embudo Creek, Cabresto Creek, Red River, Costilla, and Rio Ojo Caliente (Wilson, 1980). Data in Lansford (1979) indicate no major changes in irrigation acreage which could account for the flow reduction.

The effect of ski developments on water yield would be positive because of the cutting of water-consuming vegetation and increased snow accumulation in the cut openings (USFS, 1981a and 1981b); the effect is roughly estimated to be a 1 percent increase in total runoff. Snowmaking activities could offset this benefit (see 6.2.4).

5. Data Errors. USFS (1981a and 1981b) found no evidence to indicate that the gaging station data are in error beyond the normal limits of plus or minus 10 percent.

Prospects. Wilson (1980) summarizes the outlook for predicting future changes in climate which could alter runoff patterns in Taos County. Despite much research on the subject, no reliable predictions can yet be made. However, several of the more likely scenarios suggest that drought conditions will persist for the next several decades.

Modification of watershed management to increase runoff is being considered in the ongoing Carson National Forest management plan. Based on studies elsewhere in the Southwest, the prospect is that relatively inexpensive management practices might increase water yield by as much as 10 percent over several decades; larger increases could bring water quality or other environmental problems (e.g., see Hibbert, 1977; Solomon and Schmidt, 1979).

Major water development projects - such as importation of San Juan-Chama Project water or construction of new reservoirs - are unlikely to occur in the county due to the low economic returns from the major water user, irrigated agriculture.

C.3 STREAM STANDARDS; 1974/75 WATER QUALITY SURVEY

Standards. Table C-2 explains the state stream standards which are summarized in Table 4-1 of the text.

Survey. The bulk of water quality data available for the Rio Hondo was obtained by the EID and the U.S. Forest Service in 1974 and 1975. The data are published in the EID report Water Quality of the Rio Hondo (1975). The study was conducted to investigate; 1) how Rio Hondo water quality compares with other mountain streams and whether more stringent stream standards would be reasonable; 2) the impact of the Twining sewage treatment plant; 3) what forecasts can be made as to the impact of increases in the sewered population at Taos Ski Valley; and 4) how the impact of Twining discharge compares with the impact of irrigation at Valdez and downstream.

The names and locations of the eleven sampling stations are as follows (see also Figure 6-3):

STATION	LOCATION
HON1	Lake Fork Creek at Beaver Pond outlet
HON2	Rio Hondo at the Main Lodge bridge
HON4	Rio Hondo 50 yards above the sewage treatment plant
HON6	Sewage treatment plant discharge [a]

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[a]. These data were collected by the surveillance section of EID and cannot be used to enforce the NPDES permit; see Appendix A for compliance data.

HON8	Rio Hondo 300 yards below the sewage treatment plant
HON10	Rio Hondo 2.4 miles below the treatment plant (Italianos campground)
HON12	Rio Hondo 1.5 miles above Valdez (mouth of Canyon at USGS gage)
HON14	Rio Hondo at the Valdez bridge
HON16	Rio Hondo 1 mile above Lady of Sorrows church
HON18	Rio Hondo at Highway 3 bridge
HON20	Rio Hondo at its confluence with the Rio Grande

Stations HON1 through HON12 represent the mountainous region of the Rio Hondo. HON6 is the treatment plant discharge; HON8, HON10 and HON12 are at various distances downstream of the discharge. HON2 and HON4 were located above the treatment plant to provide background data, but note that these two stations are within the ski valley and may be affected by non-point sources such as automotive exhaust, litter, sediment washed down from roads and cabin construction, and various other products of human activity. HON1, which is on Lake Fork Creek, was added later in the study to provide better background data; however, there are cabins in the vicinity of this station, and so it also may be subject to small amounts of non-point source pollution. In 1979, station HON3 was established on the North Fork of the Rio Hondo. The North Fork passes through very little development, and so is probably representative of true background levels. Stations HON14 through HON20 represent the agricultural stretch of the Rio Hondo, and are placed to show the impact on irrigation and other cultural activities at Valdez and Arroyo Hondo.

The results of the survey are summarized in Table 6-2 and Figures 6-3 and 6-4; see also report entitled 'Rio Hondo Water Quality', December 5, 1979, which is on file at all the depositories listed in chapter 7.

C.4 WATER-QUALITY IMPACTS

As noted in the text, downstream residents in the Hondo Valley are aware of many possible adverse changes in the quality of river water. Table C-3 summarizes the problems noted by residents and their probable causes. Except as noted in section 6.2.2, most of the changes could not be attributed to sewage flows (or other effects) from TWSD and Taos Ski Valley. The following summary highlights the investigations conducted concerning problems which do not appear to result from the resort complex.

1. A survey of medical and public health personnel in Taos indicated that gastrointestinal disease is no higher in the Hondo Valley than elsewhere in Taos County. Specific reported instances of disease outbreaks were found to result from local sanitation problems rather than water-supply contamination. Nonetheless, as discussed in the text, the water in the river (and indeed all natural water in all rivers and aquifers anywhere) is not suitable for drinking without disinfection. If enough people drink enough river water without first treating it, some small proportion would be expected to experience health problems.

2. Discussions with New Mexico Department of Fish and Game personnel indicate that complaints have been received about sick and diseased fish in the river, but that water pollution was not found to be a cause of the problem. At least some of the complaints are associated with the stocking of the river with hatchery trout, which many persons find less aesthetic than native fish. However, the state agency is concerned about potential impacts of stream degradation which could adversely affect populations of cutthroat trout, a sensitive species requiring pristine environmental conditions (and currently reproducing above the main developed area in Twining).

3. Soil samples were taken from six fields in the Hondo Valley and were analyzed at New Mexico State University. All the samples showed normal soil conditions. As was stated to one resident, "nothing in the [water quality] tests have shown anything to be in the water which is not 'normal' in irrigation water in northern New Mexico . . . the problem you have reported [poor water penetration] is not related to the presence of sewage in the water. Or, if there is a relationship, it is different than has been reported elsewhere. For purposes of the EIS, we will proceed with the assumption that the sewage from Twining is not causing a clearly-defined problem with regard to the usefullness of irrigation water (although it does have effects such as odors)." A retired SCS soils scientist (James Folks) visited each field and took the samples; he observed no special or unusual conditions to support or explain the observations made by the farmers (Folks, 1980).

4. Discussions with Extension Service personnel, local veterinarians, and EID personnel all indicate that, except as noted, none of the other problems noted in Table C-3 were attributable to Twining's discharge.

C.5 NON-POINT SOURCES: GENERAL ANALYSIS

Table C-4 lists many categories of non-point sources which could have an impact on the Hondo Valley, identifies the types of pollutants associated with each, and provides a general indication of the relative importance of each source- pollutant combination. The table, and much of the text which follows, draws on information in several references, most notably EPA (1975). Information on timber harvest and grazing on National Forest Land was provided by Carson National Forest (Nordwall, 1979).

Agriculture - runoff. The major pollutant from this source is sediment resulting from erosion of cropland. Also, application of fertilizers (chemical or natural) in excess of crop needs can result in nutrient-rich runoff from the cropland. Runoff from cropland is also a major source of pesticides in surface waters. See also subsequent discussion of irrigation return flows.

There are 2736 acres of irrigated land in the Rio Hondo valley, extending from the mouth of the canyon to the Rio Grande. The major crops raised are alfalfa, pasture grasses, small grains, orchard trees and garden vegetables. Use of pesticides and fertilizers in the area is reported to be minimal.

Agriculture - animal waste. Animal wastes contribute nutrients, oxygen-demanding matter and pathogens (bacteria, viruses) to water. The problem is greatly increased if the animals are confined in feedlots or corrals. Few studies have addressed the effect of unconfined grazing on wildland water quality; the studies which have been done indicate that livestock, deer and other large animals do affect water quality, especially bacterial levels, if they have access to the stream or stream bank (Coltharp and Darling, 1975; Stephenson and Street, 1978).

There is little information available to quantify the potential impacts from this source. In the mountain area wildlife is abundant; however, livestock use is minimal (about 20 to 75 animals per month, during the summer, for the entire upper watershed. Presumably the wildlife accounts for background levels of bacteria (non-zero counts) above the ski valley.

Moderate numbers of cows, horses and other stock animals are kept by residents of the lower valley. Elevated levels of some nutrients and bacteria (see Figure 6-4) are probably attributable to this source.

Agriculture - irrigation return flows. As much as 65 percent of applied irrigation water is lost via evaporation. This results in a concentration of dissolved solids in the remaining water, thus irrigation return flows tend to increase the salinity of the receiving waters (Wilcox, 1962). Irrigation return flows can also carry increased levels of pesticides, nutrients, sediments, pathogens and other pollutants (see discussion of agricultural runoff).

The lower Hondo valley depends on irrigation as a water supply for crops. Approximately 6836 acre-feet of Rio Hondo water are used for irrigation each year, and 2734 acre-feet are returned. The major source of pollution expected from the return water is an increase in dissolved solids; this is shown by increases in conductivity of the water at downstream monitoring stations.

Automobiles. The major water pollutant from automobiles is lead. Lead compounds are added to gasoline and thus are present in automobile exhaust. These and other exhaust components settle on or near the road and are then washed into the stream by rain and snowmelt. In the same manner, oil, grease, rust and rubber can enter and pollute the stream.

From the mouth of the canyon (along Valdez) to the ski area, the road runs right by the stream, so automobile pollutants have easy access to the Rio Hondo. Annual average automobile traffic along the Taos Ski Valley road is on the order of 600 vehicles per day. Calculations made as part of this EIS (Wilson, 1981) indicate that automobile exhaust could contribute 16,300 grams of lead per year to the environment along the 8 mile stretch from the cattle guard to the ski area. If all this lead entered the stream, it would add an average of 0.00052 mg/l, which is well below the U.S. Public Health Drinking total of 0.05 mg/l. Similar calculations can be done for other automobile pollutants; the conclusion that the current level of traffic has a negligible effect on the stream water quality would apply for any increases in traffic which are less than 10-fold.

Construction. Construction activities (building roads, houses, parking lots, etc.) generally disturb the soil on and around the construction site. Thus, the major contaminant due to construction is sediment which washes from the construction site into nearby waterways. Suspended sediment increases the turbidity (decreases the clarity) of the water and generally increases salinity. Sediment which settles out of the water can silt up the stream bottom, causing changes in the biological community of the stream (see section 6.4). In addition, sediment can carry with it other constituents which had previously been stabilized in the soil, e.g., nutrients, pathogens, and heavy metals.

A number of other water pollutants can be associated with construction, for example, exhaust and oil from machinery (see automobiles), tar paper, paint, etc.

Construction differs from the other types of non-point sources in that it has a temporary, site-specific impact. Information on this source, as it pertains to possible wastewater management alternatives, is provided in section 6-1 (see especially Table 6-1).

Forests and Wildlife. Runoff from forest land carries nutrients and salts leached from leaves and humic soil. Organic debris suspended in the water can create an oxygen demand (affecting dissolved oxygen levels). Animal wastes from wildlife can contribute nutrients and pathogens in much the same manner as described above, under agriculture. Fisher and Ziebell (1980) discuss a mountain watershed in eastern Arizona where a lake was overloaded with organic matter of largely natural origin. Bacteria from campgrounds also affected this lake.

The quantity of contaminants in forest runoff is generally much lower than in runoff from other types of land use. As part of the phosphorus budget given in Table C-5, it was calculated that forest land contributes on the order of 0.025 pounds of phosphorus per acre per year. This value is at the lower end of published values for phosphorus export from forest lands. The high quality of Rio Hondo water at station HON12 (mouth of the canyon) indicates that forest contributions remain minimal throughout the upper reach of the stream.

Mining. The major pollutant from mining is "acid mine drainage", a low-pH, saline solution resulting from the oxidation of sulfide minerals (especially iron sulfide and pyrite). Heavy metals are most soluble at low pH, and so may be transported in the acid drainage. Mining may contribute sediment from fine tailings or strip-mining operation. Salinity may also be a problem.

The Rio Hondo Valley was a site of intensive mining activity around the turn of the century. Copper and gold mines were opened at Twining, Amizette, and South Fork; tailings from the Frazer copper mine are visible above Twining. The last actual mining activity occurred in 1956, when the Taos Uranium and Exploration Company built a mill to leach ore at the Frazer mine;

the mill was operated only briefly (Schilling, 1960). More recently, about a dozen exploratory cores have been drilled in the Gallina Creek area. (This creek joins the Rio Hondo below Valdez.) To date, no mining claims within the Rio Hondo watershed have been filed with the Bureau of Land Management.

On-site Systems. The concept behind sewage disposal via septic tanks and drainfields or cesspools is that the sewage will be purified by biological degradation and physical/chemical interactions as it percolates through the soil. However, even under ideal conditions some contaminants (e.g. nitrates and chlorides) will reach the groundwater. If soil conditions are poor, very little treatment of the sewage may occur. In areas with a high density of on-site systems, the ability of the ground water to dilute and flush away contaminants may be overwhelmed. Such contaminated ground water may then flow into the stream.

Numbers and types of on-site systems in the Rio Hondo Valley are estimated as follows:

Area	Number of Systems	Major Types (Approximate)
Arroyo Hondo	135	60% cesspools; 40% septic tanks
Valdez	150	60% cesspools; 40% septic tanks
Amizette	22	10% privies; 90% septic tanks; 1 holding tank
Twining lodges	3	septic tanks with dry wells; (similar to but somewhat better than cesspools)
Twining cabins	54	85% septic tanks; 15% holding tanks or other systems

The extent of pollution from these sources is unknown. It is likely that on account of steep slopes, high water table, and rapid groundwater movement, much of the contamination from Twining on-site systems reaches the river (see Table C-5). Concentrations of nutrients, salts and bacteria increase in the Rio Hondo as it passes through the lower valley (Figure 6-4); on-site systems probably account for a portion of this increase, but it is difficult to separate their contributions from that of livestock, irrigation return flows, etc. Although there are some problems with cesspools and density of septic tanks in portions of the lower valley, the soils are generally more favorable for on-site systems than are soils in Twining. The scientific literature often suggests that on-site systems should not have an impact on stream flows if soil treatment works effectively. However, system failure (overflow) is common where drainfields are not properly constructed and/or soil conditions are unfavorable. Such impacts are not unusual. For example, one recent study in Oregon showed that total coliform, fecal coliform and Salmonella all increased 10 to 100 fold as a river flowed from a protected watershed through a populated valley with homes on septic tanks (Seidler, 1979).

Road Salting. In a study of the impact of Santa Fe Ski Basin on the Tesuque watershed, Gosz (1977) concluded that the major impact on water quality came from road salting. Clearly, salts washed into a stream from the road will raise the salinity of the stream. Sodium from road salt will displace other cations (e.g. calcium) in the soil, causing breakdown of the soil structure. This results in increased sediment being washed into the stream. Effects of road salting are seen in stressed roadside vegetation.

The Rio Hondo is de-iced with a mixture of scoria (red sand) and salt. The Forest Service EIS concluded that road salting has created no water quality problems, based on conductivity measurements, and no evidence of soil or vegetation stress (USFS, 1981a and 1981b). However, data from the '74-75 survey show conductivity in the Rio Hondo to be higher in winter than in summer; this may well be due in part to the effects of road salting. It may also be due to natural seasonal differences in mineralization of rock, e.g., winter flow is primarily due to groundwater contributions, which may be more saline than surface runoff. The treatment plant contribution to the summer/winter salinity difference is on the order of 5 percent (Wilson, 1981).

Ski Area Runoff. Clearing for ski trails disturbs the soil; until vegetation is re-established, runoff from trails will carry increased loads of sediment and nutrients. Fertilizer, which is applied to the trails to assist vegetation, may contribute nitrogen and phosphorus to runoff. Other possible pollutants associated with a ski area (beyond those of construction, automobiles, etc.) include oxygen-demanding material from paper litter, oil, grease and heavy metals from ski lift and maintenance equipment.

Proposed development of Taos Ski Valley will involve the clearing of about 60 additional acres for ski trails and lift corridors over the next ten years. As part of the phosphorus budget (Table C-5) it was established that fertilization may have contributed 50 to 100 kilograms of phosphorus to the stream in 1980. Future impacts of fertilizer will depend on the amount used and the method of application; EID personnel have expressed concern that use of calcium hydroxide to increase fertilizer phosphorus availability may also increase phosphorus runoff into the stream (Oppenheimer, 1981). This effect will probably be very small, especially since application of lime reduces the amount of phosphorus application needed.

Timber Harvest. Significant soil disturbance occurs during timber harvesting, resulting in increased sediment loadings from harvested areas. In addition, the cleared area is more affected by rainfall and receives less erosion-controlling forest debris. Temperatures of runoff and streams may increase due to cleared areas receiving more sunlight.

Currently there are no contracts or permits for the sale of timber within the Rio Hondo watershed. The only timber harvest that has occurred within the past decade has been a small amount of clearing for ski trails at Taos Ski Valley. As discussed in section 6.1, these areas and those cleared earlier may still have a small effect on stream sediment loads.

C.6 NON-POINT SOURCE PHOSPHORUS BUDGET

As part of the wasteload allocation research (Appendix B.4), Lee Wilson and Associates, Inc. prepared a detailed budget for point and non-point source phosphorus discharged within TWSD, for existing and future conditions. This study is summarized in Table C-5, which includes extensive footnotes to explain the methodology. It should be noted that existing conditions were calculated using data for the period November 1979 through October 1980. The major implications of the budget are discussed in Appendix B.4.

C.7 DOWNSTREAM PHOSPHORUS IMPACTS

As noted in Appendix B.4, Twining's wasteload allocation allows phosphorus pollution up to the stream standard. Below Twining additional inflows to the river would dilute the phosphorus to below the standard, so that there would be 'room' for additional discharges without violation of the standards. It is possible to calculate the downstream impacts of TWSD's discharge and thus determine how much of the downstream waste assimilation capacity would be used up by the District, and how much is left over for others.

Table C.6 contains these calculations, as prepared by Dave Tague of EID. The table shows the concentration of phosphorus near Valdez (HON12) and at Arroyo Hondo (HON18) which would be attributable to Twining. ("Attributable to Twining" includes both sewage discharge and non-point source loading from activities in the ski valley.) The table indicates that at Arroyo Hondo, concentrations of phosphorus due to Twining would amount to a maximum of 40 percent of the standard; the average amount would be 24 percent. At Valdez the maximum effect is 50 percent of the standard and the average is 31 percent.

Although Table C-6 would indicate that Twining's phosphorus allocation has a moderate impact on the lower Rio Hondo, several other perspectives should be brought to bear on the calculations.

First, the concentrations at HON8 were calculated assuming that Twining's effluent would be treated to 1 mg/l throughout the year, and that the plant flows would be lower in the summer months. Since then, EID has decided to recommend a permit which allows less phosphorus treatment in months with higher stream flows and lower discharges (see Appendix B.4). Thus, Twining's contribution may be higher than shown on the table for the summer months; this effect still assumes the area does not become a summer resort (in which case even greater changes would occur). Were the concentration at HON8 to be 0.1 mg/l in every month of the year, the concentrations at Valdez and Arroyo Hondo attributable to Twining would average about 0.05 mg/l and 0.03 mg/l, respectively, or 50 percent and 30 percent of the stream standards.

Second, EID's current policy is to allocate downstream phosphorus wasteloads on a first-come, first-served basis; phosphorus treatment of new point sources will not be required until all of the wasteload is allocated. The result of this approach is that approval of a few small new point sources would fully use up the allocation, leaving no room for growth of the many non-point sources in the downstream area. This conclusion can be illustrated by consideration of the proposed NPDES permit for the La Hacienda Condominiums near Valdez, a new development seeking approval for an approximately 15,000 gpd package treatment plant. As proposed by EID, the permit would not require phosphorus removal.

Assuming that La Hacienda effluent contains 10 mg/l of phosphorus (a typical value for such treatment plants), their discharge during low-flow conditions (7.2 cfs) would increase stream phosphorus by nearly 0.03 mg/l. Under these same low-flow conditions, Twining would be contributing 0.05 mg/l. Water quality data suggest that existing non-point sources in this area might add another 0.01 mg/l. Thus, the phosphorus concentration could amount to 0.09 mg/l, or 90 percent of the stream standard.

A comprehensive analysis of this subject would require consideration of many additional factors. For example, phosphorus is readily adsorbed onto soil particles; therefore, stream sediments act as a phosphorus sink and effectively reduce the amount that is available for algal growth. Also, EID has assumed that there is no net removal of phosphorus by aquatic organisms (algae). In reality, the biomass may provide a net uptake of phosphorus. Alternately, the biomass could take up phosphorus during some periods (blooms), release it at others (when the plants die), and complicate the relationships of Table C-6, whereby phosphorus shows up downstream immediately after its discharge by Twining.

C.8 TWINING WATER SYSTEM; PER CAPITA FLOW ESTIMATES

History, Water Rights. In 1967, a predecessor of TWSD, the Twining Water and Sewer Users Association, received a Farmers Home Administration loan of $40,000 to construct a community water system. A 100 foot deep domestic well was drilled as a part of that project near the TSV, Inc. office but did not produce water adequate to serve the area and was eventually abandoned. Instead, the Association decided to hook up to the existing Pattison Trust Water System which had been developed to serve the O. E. Pattison subdivision. Arrangements were made with the Trust to lease the water lines, an agreement which is still in effect. The Twining Water and Sanitation District was formed in 1977 for the purpose of obtaining grant monies from the state and EPA to upgrade the existing wastewater system constructed in 1967. Transfer of ownership of portions of the water and sewer system owned by the Association to the District has been completed.

Neither the Twining Water and Sewer Association nor the Twining Water and Sanitation District own any water rights. Due to the lease agreement with the Pattison Trust, the Association has use of the Pattison water right, which amounts to a diversion right of 218.2 acre-feet per year and a consumptive right of 10.91 acre-feet per year.

Water Facilities. The facilities owned by the Pattison Trust include three sources for water - Upper Infiltration Gallery, Schwendi Infiltration

Gallery and Beaver Pond Infiltration Gallery - and the system up the valley from the junction box located east of the base area. The TWSD system begins at the junction box and serves most of the buildings below (BLL, 1980). The system serves 14 commercial customers and 59 residential customers. The diverted water which enters buildings is either consumed or returned as sewage; except for sewage disposed of on-site (mostly by cabins and the Kandahar), the return flows are all treated at the TWSD sewage plant and discharged to the Rio Hondo. However, by far the largest portion of the diversions is not used for domestic purposes, but becomes what is known as by-pass flows. Because many of the water pipes are not deeply buried and are therefore vulnerable to freezing, many lodges, condominiums and private residences have a by-pass pipe. This pipe runs outside each building, with water continuously flowing through it. The continuous flow of water usually prevents pipes from freezing. Most by-pass pipes discharge to the Rio Hondo; however, some pipes discharge onto the ground, to a septic tank or to a back-up water storage container. Some users shut off their by-pass valves in the summer, but many do not.

Improvements are planned to correct the current inadequacies of the system. They include installation of meters, replacement of one infiltration gallery, provision of storage facilities, and improvements to the distribution system and development of water supply sources.

Sewage Flows. Meter records have been insufficient to permit accurate measurement of diversions, by-pass flows and return flows. Thus, reliable direct data on water use and sewage flows are not available. To provide at least approximate estimates of water use and sewage flows within TWSD, Lee Wilson and Associates (LWA) developed estimates of yearly and daily sewage flows in the following manner.

An initial review of the literature indicated that at a number of other ski areas, sewage flow is estimated at 15 gallons per capita day (gpcd) per day skier or employee and 90 gpcd per overnight resident or guest (Wilson, 1981). Sewage flow is approximately 70 percent of diversion in most rural areas.

Interviews were conducted by LWA with all condominiums, lodges, apartments, cabins and Taos Ski Valley, Inc., to provide information about numbers of yearlong, summer and winter residents, guests and day skiers using the water system. This information was correlated with actual sewage flow data obtained at several peak periods, including the Thanksgiving and Christmas holidays of the '79-80 season. Despite the variability in data obtained at different times, the most consistent interpretation of the results indicated that: infiltration into the system averages about 22,000 gpd; the per capita sewage discharge is 10 gpcd for day visitors and employees; and the per capita sewage discharge is 50 gpcd for overnight occupants. The literature indicates that the gpcd numbers are the minimums which could be expected at a ski area.

The inconsistencies found during the course of measurements seemed to be the result of problems with the metering equipment and/or significant variability in infiltration rates. High infiltration rates create difficulties in determining the proportion of actual sewage flows. However, on the basis of the data collected, the 50:10 gpcd sewage flow ratio appears to be reasonably accurate.

Water Use. If one assumes that 70 percent of water diverted for domestic use is return flow, and 30 percent is consumed; and if return flows for day visitors average 10 gallons per day and return flows for overnight residents average 50 gallons per day; then the average day visitor requires a water diversion of 14 gallons per day of which 4 gallons are used consumptively; and the average overnight resident requires a water diversion of 71 gallons per day, of which 21 gallons are used consumptively. As a further test of the assumptions used for this study, daily water meter readings were taken at several area residential facilities. These readings were then correlated with the number derived by applying the estimated 14 and 71 gpd to populations at each facility. There was less than a five percent variation between actual readings and the derived figures, thus confirming the reasonableness of the assumptions. When these numbers are used in conjunction with population data (Table 6-7), it is possible to calculate both peak water demand and annual water use (diversions, return flows, consumptive use). The latter - expressed in acre-feet per year - is critical to discussions of water rights.

Table C-7 provides estimates of annual domestic consumptive water use in TWSD, for existing conditions and two of the population projections given in Table 6-7 (those for alternatives B and E, respectively). For existing conditions, diversion is estimated at 31.1 acre-feet per year (AFY); 30 percent or 9.3 AFY would be consumed and 70 percent or 21.8 AFY would be returned as sewage. For the two projections, the same assumptions were made, with the exception that water conservation was taken into account, thus reducing consumptive use of all new development by one third.

These estimates do not include bypass flows, which must be considered in evaluating the total water system. Attempts by WRD to obtain accurate information on amounts of diversion for bypass flows thus far have been unsuccessful. Most such diversion occurs around individual cabins. Measurements of total diversion between June and November 1980, which WRD used to arrive at an annual diversion of 141.1 AFY, would suggest that 105 AFY was used for the bypass system, since 31.1 AFY was used for domestic diversion and about 5 AFY is the estimated diversion for snowmaking. However, the results of the interviews of all water users in the ski valley indicated 532 AFY in bypass flow based on pipe diameters and reported duration of use. It appears that it is not possible to determine the exact amount of bypass flow within this approximate 105-500 AFY range based on the information gathered thus far. Clearly accurate determination of return flows would require monitoring of all or most of these bypass lines (plus measurements at the sewage treatment plant, Kandahar etc.). The State Engineer probably will not require such measurements to be made.

There are no accurate data regarding water use for snowmaking. On 2-11-81, WRD ordered that diversion of water for snowmaking be stopped for the reason that it does not fall within the category of sanitary/domestic use. WRD determined that for the time period 12-3-80 to 2-10-81, six acres were supplied with snow at a rate of 30 gpm over 315 hours. A total of 1,134,000 gallons of water was diverted for snowmaking, or 3.48 AF. Assuming that this rate of use had extended for 100 days (the approximate number of days the snowmaking equipment is used each season), about 5 AF would have been diverted. WRD calculates that 30 percent of diversions for snowmaking are consumed; this is based on the net evaporation of natural snow during the winter at Twining's elevation. The District disagrees on the basis that most of the snow is used at the beginning of the season to create a base, is not exposed during most of the year, and therefore only about 10 percent evaporates. This disagreement is as yet unresolved.

In order to resume snowmaking in the future, TSV, Inc. may have to apply for a permit from the State Engineer, unless it is able to reestablish use of the water-system permit. This has not been done as of July, 1981; it would require transfer of already purchased irrigation rights on the Rio Hondo.

TABLE C-1. FLOW DATA, RIO HONDO AT VALDEZ

Figure 14. SURFACE HYDROLOGY OF TAOS COUNTY SUMMARY OF GAGING RECORDS

Stream Name Rio Hondo near Valdez, N. M. USGS Number 8-2675 Period of record August 1934 to present

Basin area 36.2 sq. mi. Gage location 36° 32' 30"N, 105° 32' 21"W Other data none

Factors affecting record Footnote I Comments minimum result of freezeup

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MEANS AND EXTREMES

Average flow:	35	cfs
or:	25,360	AF/year
or:	701	AF/SM/year
Avg. flow 1955-1974:	30.7	cfs
or:	22,240	AF/year
or:	614	AF/SM/year

Maximum: 541 cfs on May 13, 1941
Minimum: 1 cfs on January 27, 1942

FLOW DURATION ESTIMATES

1931-1973 as adjusted by USGS

Basis of adjustment: 8-2765,8-2763

Flow exceeded following percent of the time:

0.1	333	cfs
1.0	237	cfs
5.0	128	cfs
10.0	83	cfs
50.0	17.7	cfs
90.0	10.1	cfs
95.0	8.8	cfs
99.0	6.8	cfs
99.9	4.9	cfs

$\bar{Q}$=34.9 cfs

MEAN MONTHLY DISCHARGE

January:	614.45 AF
February:	562.75 AF
March:	737.40 AF
April:	1,550.55 AF
May:	4,396.50 AF
June:	5,104.50 AF
July:	2,377.95 AF
August:	1,815.00 AF
September:	1,273.45 AF
October:	1,042.10 AF
November:	821.20 AF
December:	685.45 AF

LOW FLOW RECORDS

Lowest mean discharge for a given period of consecutive days

90-days:	lowest low	6.9	cfs
	median low	10.7	cfs
	highest low	17.6	cfs
30-days:	lowest low	6.7	cfs
	median low	10.0	cfs
	highest low	15.3	cfs
7-days:	lowest low	4.8	cfs
	median low	8.3	cfs
	highest low	14.4	cfs
3-days:	lowest low	4.3	cfs
	median low	8.0	cfs
	highest low	13.3	cfs
1-day :	lowest low	4.0	cfs
	median low	8.0	cfs
	highest low	13.0	cfs

HIGH FLOW RECORDS

Highest mean discharge for a given period of consecutive days

90-days:	highest high	205.0	cfs
	median high	72.7	cfs
	lowest high	23.6	cfs
30-days:	highest high	291.0	cfs
	median high	108.0	cfs
	lowest high	32.1	cfs
7-days:	highest high	361.0	cfs
	median high	121.0	cfs
	lowest high	34.4	cfs
3-days:	highest high	403.0	cfs
	median high	125.0	cfs
	lowest high	35.0	cfs
1-day :	highest high	416.0	cfs
	median high	132.0	cfs
	lowest high	36.0	cfs

SEASONAL FLOW

% flow runoff season	56
% flow storm season	31
% flow winter season	13

I. Records poor/fair in winter.

TABLE C-2. STREAM STANDARDS FOR THE RIO HONDO.

All standards are maximum allowed levels except dissolved oxygen (which is a minimum) and pH (which is an acceptable range). lt = less than; gt = greater than; mg/l = one milligram per liter (= one part per million).

Parameter (symbol)	Standard	Water Use(s) Protected	Basis
Un-ionized Ammonia Nitrogen (NH_3-N)	0.02 mg/l a/	fish culture; coldwater fishery	At concentrations above 0.02 mg/l, un-ionized ammonia is toxic to fish, particularly trout.
Conductivity (cond.)	400 Micromhos	all	Reflects natural stream quality based on sampling data. Excessive increases in conductivity could result in changes in the stream's biology.
Dissolved Oxygen (DO)	6.0 mg/l	fish culture; coldwater fishery	5 mg/l is the minimum level to protect aquatic species, particularly trout. 6 mg/l leaves a margin of safety.
Total Inorganic Nitrogen (N)	1.0 mg/l b/	fish culture; coldwater fishery; secondary contact recreation	Inorganic nitrogen is primarily nitrate, nitrite, and ammonia. These are the biologically available forms of N. 1 mg/l or less total N avoids excessive growth of nuisance algae.
pH	6.6 - 8.8	all	Typical natural values, based on sampling data. Values outside this range could result in decreased species diversity and could change the stream chemistry.
Temperature (temp)	20° C (68° F)	fish culture; coldwater fishery	Temperatures above 20° C place stress on trout and other coldwater fish.
Total Chlorine Residual (Cl_2)	0.002 mg/l	fish culture; coldwater fishery	At levels above 0.002 mg/l chlorine is toxic to aquatic organisms, particularly trout.
Total Organic Carbon (TOC)	7 mg/l	fish culture; coldwater fishery	Protects against excessive organic loadings which would lower dissolved oxygen.
Total Phosphorus (Tot-P)	0.1 mg/l as P	fish culture; coldwater fishery; secondary contact recreation	To prevent excessive algal growth. This level is the lowest which is reasonably obtainable, given natural stream quality.
Turbidity (turb.)	25 FTU c/	all	Turbidity generally indicates how clear the water is. The standard reflects stream conditions for NM mountain streams.
Fecal Coliform Bacteria (fecal coli.)	100 per 100 ml (monthly logarithmic mean); no more than 10% of samples may exceed 200 coliforms per 100 ml.	domestic water supply; irrigation; livestock watering; recreational value	Fecal coliform, not itself harmful, is an indicator organism for more dangerous bacteria and viral forms. At levels over 200/100 ml, there is a sharp increase in the number of disease-producing organisms found in the same sample.

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a. This is the revised standard adopted by the NMWQCC in April 1981; State Attorney General and EPA approval are pending. Previous standard was 0.2 mg/l for total ammonia nitrogen.
b. As per note a. Previous standard was 0.8 mg/l for nitrate nitrogen.
c. FTU is an arbitrary unit used to measure turbidity levels.

TABLE C-3. PROBABLE CAUSES OF HONDO VALLEY WATER PROBLEMS

Problem	Probable Causes
Poor penetration of injection water. More frequent irrigation needed.	Decrease in runoff has lowered water table enough to increase the amount of water needed to saturate the soil. Excessive application of manure can clog the soils.
Health problems (gastro-intestinal disease)	Poor hygiene and/or pollution of well water by cesspools. Medical professionals indicate general improvement in community health in recent decades.
Cattle deaths	Copper deficiency (related to copper in the soil).
Dying vegation along ditches	Oyster scale (a common tree disease). Experimental herbicide application by Extension Service. Fruit trees don't do well with high water table.
Dead, sickly, and bad-tasting fish.	Difference between native and stocked fish. Unusual problems not confirmed by New Mexico Fish and Game Department.
Suds in the water	Surfactants produced by natural proteins. Possibly surfactants from OSS.
Slime on the stream bottom.	Nutrient enrichment from a vareity of sources including Twining effluent.
Ducks and geese seen less frequently along the river.	Not confirmed by New Mexico Fish and Game Department.Rio Hondo has never been a good habitat for water fowl.

TABLE C-4. POTENTIAL WATER-QUALITY IMPACTS OF VARIOUS NON-POINT SOURCES

Number of asterisks reflect relative significance of problem in Rio Hondo watershed; *** = most significant.

Non-point source	Water Quality Problem Sediment	Salinity	pH	Heavy Metals	Nutrients	Pathogens	Oxygen-Demanding Material	Other (Pesticides, oil, etc.)
Agriculture -runoff	**		*		**		*	**
-animal wastes					***	**	**	
-irrigation return flows	*	***	*		*		*	*
Automobiles				***				**
Construction (houses, roads)	***			*	*			*
Forests & wildlife	*	*			*	*	*	
Mining	*	*	***	***	*		*	
Septic tanks & cesspools		*		*	**	***	*	*
Road salting	*	***						
Ski area runoff	**	*			**		**	*
Timber harvest	***	*			**		**	

TABLE C-5. EXISTING AND FUTURE NON-POINT SOURCES OF PHOSPHORUS ABOVE TWINING SEWAGE PLANT DISCHARGE POINT

Assumptions used to develop figures are given in footnotes; more detailed calculations are on file at Lee Wilson and Associates, Inc., Santa Fe, New Mexico.

A. WASTELOADS REACHING RIO HONDO ON AN ANNUAL BASIS, KILOGRAMS

	EXISTING CONDITIONS[a/]		FUTURE CONDITIONS[b/]	
	Low Estimate[c/]	High Estimate[c/]	Low Estimate[c/]	High Estimate[c/]
Natural[d/]	70	70	70	70
Base Area[e/]	20	200	10	400
Trails[f/]	50	100	25	200
Sewage[g/]	50	100	25	200
Total, normal flows[h/]	190	470	130	870
Total, low flows[h/]	70	300	35	600

B. ESTIMATED BACKGROUND CONCENTRATION OF PHOSPHORUS, MG/L

	EXISTING CONDITIONS[a/]		FUTURE CONDITIONS[b/]	
	Low Estimate[i/]	High Estimate[i/]	Low Estimate[i/]	High Estimate[i/]
Normal Flows[j/]	0.015	0.036	0.010	0.093
Low Flows[k/]	0.016	0.067	0.008	0.134
Observed[l/]	0.022		-	
Allocation[m/]	0.03		0.06	

a. Existing conditions were calculated using data for the period November 1979 through October 1980. This is the period over which EID collected samples from the Rio Hondo on a monthly basis, the resulting data being used as their basis for wasteload allocations.

Runoff data for Rio Hondo at Valdez were obtained from the USGS office in Santa Fe (provisional data). Valdez flows were converted to Twining values using Louis Reiland's curves.

b. Future conditions: to reflect worst-case, assumes extensive development of area (3500+ pillows).

c. Low and High estimates: precise calculations of loading are not possible; therefore a range of likely values is given. It is not certain that this range encompasses actual loading rates.

d. Based on measured loading, North Fork of the Rio Hondo (HON3). Runoff at this point was assumed to be in the same proportion to runoff at HON4 as the sizes of their respective watersheds. The average measured phosphorus concentration at HON3 for 1980 was 0.005 mg/l. This calculates out to a loading of 0.025 pounds per acre year, a value in agreement with published estimates of phosphorus loading in runoff from forested watersheds.

e. Represents loading from 'urban runoff'. Calculated by multiplying acres of developed land times a factor which indicates phosphorus loading per acre. For an EIS for Norman, Ok., LWA has done extensive work to develop loadings for various parameters from different types of land use areas. For phosphorus from commercial and residential lands, the loadings are 4.8 lbs/ac/yr and 3.8 lbs/ac/yr, respectively. We considered the base area to have 55.6 acres of "commercial" land (lodges, parking lots, etc.). and 50 acres of "residential" land (cabins).

We assumed the resulting loadings to be at the upper end of the likely range, since "urbanization" at Taos is less intensive than in Norman. Calculations based on USFS measurements of sediment yield for the parking lot indicate that the loading may actually be much less, so we reduced the above figure by an order of magnitude to use as the "low estimate".

For future conditions, the low estimate assumes that Twining implements a well-functioning system to control runoff from the parking lot and other disturbed areas. The high estimate reflects a worst-case situation in which our "existing" high estimate is correct, a large amount of development occurs in the base area, and no runoff controls are implemented.

f. Represents runoff of fertilizer used by TSV, Inc. 12.5 tons of 16.20.6 fertilizer were applied to the trails in summer of 1979. We assumed that five to ten percent of the phosphorus in this fertilizer reached the Rio Hondo in water year 1980. This assumption seems reasonable, given the steep slopes, rocky soils, and high water table. For future conditions, the low estimate reflects better controls on fertilizer application practices.

g. Represents phosphorus in ground water contributed by septic tanks and cesspools. The gross discharge of phosphorus is based on an actual count of facilities in the District, estimated to discharge 3,028,000 gallons per year, and assumed concentrations of P in effluent (10 mg/l); the range in net values reflects assumptions as to how much treatment occurs as the wastewater seeps through the soil. Normally, one would expect most of the phosphorus to be retained by the soil. However, Twining is unusual in having rocky soils and a very high water table. EID personnel have noted evidence of "breakthrough" of phosphorus from the discharge of one lodge's OSS. Therefore, our low estimate assumes that about half the phosphorus is retained by the soil; the high estimate assumes that nearly all of it passes through into the stream.

The future low estimate reflects elimination of many existing OSS due to new hook-ups to the plant. The high estimate assumes development in Twining with new cabins/lodges using OSS.

h. For normal flows, the total reflects the contribution from all sources. For low flows, it is assumed that natural and trail contributions will become negligible due to lack of runoff.

i. Equals total wasteload divided by annual flow.

j. For existing conditions, the 1980 water year flow: 15 cfs = 1.3×10^{10} liters/year. For future conditions, the average of 1960-1979 flows: 10.5 cfs = 9.4×10^{9} liters/year.

k. Using a value for a hypothetical "low-flow" year, calculated by weighting EID's revised monthly low flows: 5 cfs = 4.5×10^{9} liters/year. For critical low-flow conditions in winter, flow would be about 35% less. Wasteloads would be expected to be even smaller in proportion, since most loading occurs in association with runoff.

l. Average of values measured for 1980 water year.

m. Value used by EID in its wasteload allocation.

TABLE C-6. DOWNSTREAM PHOSPHORUS IMPACTS.

Table indicates amount (kilograms/month) phosphorus discharged from TWSD and the relative effect (milligrams/liter) of this discharge at three locations (Twining, Valdez, Arroyo Hondo) during low-flow conditions.

MONTH	CONDITIONS BELOW TWINING SEWAGE OUTFALL PIPE			CONDITIONS AT VALDEZ		CONDITIONS AT A. HONDO		DOWNSTREAM IMPACTS OF TWINING	
	Change in P flux, kg/mo	Flow, cmm	P, mg/l	Flow, cmm	P, mg/l	Flow, cmm	P, mg/l	% P, Valdez	% P, A. Hondo
Jan	81.0 to 26.0	262	0.10	546	0.05	910	0.03	50	30
Feb	65.4 to 23.5	237	0.10	493	0.05	754	0.03	50	30
Mar	102 to 26.0	262	0.10	607	0.04	1290	0.02	40	20
Apr	121 to 25.2	335	0.08	690	0.04	352	0.04	40	40
May	73.7 to 25.3	688	0.04	1670	0.02	311	0.02	20	20
June	93.2 to 24.5	665	0.04	1610	0.02	382	0.02	20	20
July	16.8 to 10.5	468	0.02	1060	0.01	387	0.01	10	10
Aug	21.9 to 14.5	437	0.03	986	0.01	410	0.01	10	10
Sept	5.4 to 5.9	368	0.02	807	0.01	382	0.01	10	10
Oct	33.5 to 19.4	343	0.06	743	0.03	417	0.03	30	30
Nov	8.5 to 25.2	253	0.10	631	0.04	506	0.04	40	40
Dec	42.4 to 26.0	262	0.10	546	0.05	910	0.03	50	30
Totals	665 to 252								
								31	24

Based on calculations made by Dave Tague, EID, 1981.

Change in P flux: estimated kilograms/month of phosphorus discharged from TWSD (including non-point sources and treatment plant); first number is present value; second number assumes increased non-point sources (due to growth), major decrease in treatment plant discharge (due to construction of new facilities) and net contribution which just meets stream standards in each month. Values assume major use of area is in ski season; if TWSD becomes summer resort, flux in summer would increase substantially.

Flow: seven-year, 10-day low flow in cubic meters per month (CMM).

P, mg/l: maximum concentration of phosphorus (milligrams per liter) due to effects of Twining.

% P: portion of stream standards (wasteload assimilation capacity) allocated to Twining. Remaining percent is available to downstream users.

TABLE C-7. DOMESTIC CONSUMPTIVE WATER USE

	Existing		Lowest Projection a/		Moderate Projection b/	
	Person Days	AFY	Person Days	AFY	Person Days	AFY
Winter:						
Day Only	220,437	2.84	358,071	4.62	403,886	5.21
Overnight	77,238	5.04	201,824	11.99	260,015	14.54
Summer:	21,964	1.44	36,533	2.39	44,167	2.89
Total	319,639	9.32	596,428	19.00	708,068	22.64

a. Normal increase based on non-peak skiing and additonal cabins; capacity alternative B.
b. Increase treatment plant to 95,000 capacity; capacity alternative E.

TABLE C-8. BENTHIC MACROINVERTEBRATES IN THE RIO HONDO.

PLECOPTERA (stoneflies)

Perlodidae
Megarcys signata

Isoperlinae
Hesperoperla pacifica

Chloroperlidae A and B

Nemouridae
Zapada haysi
Prostoia besametsa

Capniidae
Taenionema sp.
Pteronarcella badia

TRICHOPTERA (caddisflies)

Rhyacophila acropedes
R. angelita
R. tucula
R. coloradensis
R. unknown L.
Oligophlebodes sp.
Pseudostenophylax sp.
Brachycentrus sp.
Micrasema sp.
Arctopsyche grandis
Glossosoma sp.
Dolophilodes sp.

EPHEMEROPTERA (mayflies)

Epeorus longimanus
E. sp.
Stenacron sp.
Cinygmula sp.
Rithrogena robusta
Baetis sp.
Ameletus sp.
Paraleptophlebia sp.
Ephemerella inermis
E. doddsi

HEMIPTERA (true bugs)

Corixidae

COLEOPTERA (beetles)

Elmidae Genus A and B

ODONATA (dragon-damsel flies)

Zygoptera

OLIGOCHAETA (worms)

Naididae

PLATYHELMINTHES (roundworms)

Polycelis coronata

HYDRACHRINA (water mites)

Genus A and B

GASTROPODA (snails)

NEMATOMORPHA (horsehair worms)

DIPTERA (true flies)

Chironomidae Genus A and B

Chironominae
Chironomus sp. A and B
Glyptotendines sp. A and B
Calospectra sp. A, B, and C

Tanypodinae
Procladius sp.

Diamesinae
Diamesa sp. A and B

Orthocladinae

Hydrobaena
Brillia sp.
Eukiefferiella sp. A and B
Corynoneura sp. A and B
Psectrocladius sp.
Cricotopus sp. A and B

Simuliidae

Tipulidae A and B
Tipula sp.
Hexatoma sp.
Dicranota sp.
Antocha sp.

Blepharoceridae

Ceratopogonidae
Pericoma sp.
Protoplasa fitchii
Hemerodromia praecatoria
Wiedemannia sp.

Source: Gerald Jacobi, New Mexico Environmental Improvement Division

APPENDIX D

SOCIOECONOMIC ISSUES AND DATA

APPENDIX D. SOCIO-ECONOMIC DATA

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As described in section 6.6.2, the interaction between tourism and local social and economic conditions is complex. For this EIS, research has concentrated on major economic issues which were capable of some degree of quantification within the research scope of the facilities planning process.

D.1 REVENUES AND EMPLOYMENT GENERATED BY TAOS SKI VALLEY

The Forest Service EIS (USFS, 1981a and 1981b) developed an economic model for quantifying economic benefits of the resort complex which accrue to the region (see Table 6-9 for information on how economic benefits are distributed). The following summarizes results of the model for the 1979-80 ski year.

1. Skier Visits	265,000
2. Revenue	
Gas & Auto	$1,362,000
Food & Drink	1,852,000
Retail Trade	5,976,000
Lodging	3,544,000
Other Services	8,055,000
Construction	2,171,000
All Other	3,837,000
Total Revenue	$26,797,000
3. Person Years of Employment	1,300
4. Personal Income [a]	$11,532,000

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[a] Included in Total Revenue.

D.2. EMPLOYMENT IN TWSD

Information regarding resort employment and hiring practices was gained largely through discussions with officials and lodge owners in the area.

Taos Ski Valley, Inc. To date, employment peaked in the 1979-80 season at 228 persons, but this figure will vary as conditions and markets change. Summer jobs at the facility regularly drop to 50 people, as the only available positions involve trail and lift maintenance and administrative duties.

Of the staff:
- 27 percent are Spanish surnamed
- 29 percent are female
- 66 percent live in Taos or the Rio Hondo valley yearround; many have arrived in New Mexico in the last 10 years.

The positions on the TSV, Inc. staff include:

Administrative/office	10
Lift operators	20
Ticket sales and checking personnel	14
Ski patrol	19
Ski instructors	72
Lift and mountain maintenance	7
TOTAL	142

Some 86 additional persons are employed in capacities of equipment and clothing sales and service, nursery attendants, and various other janitorial and service positions. In recent years, the majority of new jobs have been for instructors, ski patrol and lift operators. Although the ski area holds no formal designation for supervisors, some 20 staff persons could be classified as such.

Lodges and Condominiums. Interviews reveal that the total work force for the lodges and condominiums, which includes proprietors, maids, waiters, cooks, etc., varies between 86 and 105 persons during the ski season. Summer employment can be as low as 28 persons, since only the proprietors and "live-in" maintenance workers remain on payroll.

Owners indicated that about one-half of their employees are native to the area and of Spanish heritage. Figures for individual facilities ranged from 75 to 42 percent, and, thus, in some cases equal the county population balance. Employed predominantly in service sector positions, the average hourly wage for the Taoseno was $4.75 per hour inclusive of wages and tips. This rate is relatively standard for service sector employees regardless of background. Fringe benefits are few, which is a characteristic of service jobs nationwide. Persons who return for work the following year are usually given a pay increase. Opportunities for advancement are limited, given the fact that facility owners are also the supervisory and management personnel on a small staff.

Local Employment. While the ski industry does provide jobs for long-time local residents, much of the direct employment is created for persons who are either not yearround residents of the area or persons who have moved to the area in recent years. The native Spanish population is somewhat at a disadvantage when competing against newcomers for jobs in the ski valley. Most of the winter transients come to ski. Employees with skiing skills are an attraction to lodge and condominium owners since staff people who ski and easily mingle with ski crowds are an advertisement for lodges and condominiums. Few native job applicants are skiers while most newcomers seeking jobs at the ski valley are. Work preferences of job applicants are also significant. Lodge owners indicated that the majority of their Taoseno job applicants preferred the standard 8 to 5 workday. In a resort area, this choice limits available jobs and leaves an open market for job seekers who want to locate in the area on a temporary or permanent basis and do not need to have a regular work day.

During the summer months, few employees are retained. Although many are absorbed into the summer employment market, quite a few of these individuals either cannot or do not attempt to locate jobs and so are unemployed.

D.3 TAX SUBSIDY ISSUE

The issue has been raised as to whether federal, state and local tax dollars subsidize the private enterprise which occurs in the Twining Water and Sanitation District. A brief study of this issue reveals that skiers appear to generate much more in tax revenues than they require from government expenditures; if so, commercial activities in the District are not subsidized by government funds whe viewed as a whole.

Methods and Data. As a general review of this issue, designed to determine if a detailed analysis was required, Lee Wilson and Associates estimated state and county gross receipts taxes collected from skiers in 1978-79 at Taos Ski Valley and compared this figure to major government expenditures for the Twining Area. State, county and municipal expenditures were examined. Federal expenditures have also been considered; however, since the major identifiable revenue source in this case is the USFS permit fee rather than gross receipts, the effect on federal expenditures is considered seperately at the end of this discussion.

The standard assumption in a free enterprise society is that businesses generate more tax revenues than they require. (If this were not true overall, there would be no money left over for "non-profit" uses, such as salaries of government employees.) Nonetheless, it is often found that the public sector contributes quite a bit to the benefit of the private sector. To present a worst-case analysis and help highlight this possibility, the analysis was structured to try to overstate public expenditures associated with Twining and to understate public revenues generated by skiing. The reasoning was that such a bias was necessary to ensure that the analysis did account for any small subsidies which might exist but not be readily identified among public expenditures.

Gross Receipts Collected. The estimate of gross receipts tax generated by TSV, Inc. was calculated by multiplying the number of annual skier days, by the estimated number of dollars spent daily, by the tax on gross receipts:

	230,000	TSV annual skier days 1978-1979
x	$61.50	(the lowest estimate of average daily skier expenditure)
=	$14,145,000.00	annual skier expenditures
x	.04	tax on gross receipts
=	$565,800.00	state collected revenue from skier expenditures (including State collected County gross receipts)

State Expenditures. The major expenditure of state tax funds which could be identified as unique to the Twining area, i.e. not shared by other county residents, is the construction and annual maintenance of that section of N.M. State Highway 150 between Valdez (at the mouth of the canyon) and Taos Ski Valley (New Mexico State Highway Dept., 1980).

$57,311.00	annual road construction costs amortized over 20 years
$10,000.00	annual maintenance, (includes paving, snow plowing and fence repair)
$67,311.00	Estimated major state expenditures to support commercial activities in the Twining Water and Sanitation District.

County Expenditures. Discussion with the county fiscal agent indicated that there were no county expenditures that were either unique to the Twining area nor any that were disproportional to expenditures in other communities. Therefore, it was assumed that county expenditures for Twining were equal to their share of the county population. In order to count tourists who, while not county residents, do contribute to the area's population, an annual population equivalent was determined. To do this, total visitor days in 1978-1979 were divided by the number of days in a year and this figure added to the permanent population of Twining. This resulted in the equivalent of 682 yearround people or about 3 percent of the county population. This analysis will actually overstate the expenditures required for tourists since they do not use many of the county's services. Total county expenditures in 1978-1979 were $5,160,195. Much of this amount, however, was flow-through funds, such as $2,194,600 for a federally-funded housing authority project. Eliminating these funds, actual county expenditures were about $1,700,000. Three percent of this figure is $51,000, roughly what can be attributed to Twining.

Municipal Expenditures. Obviously, no Town of Taos funds are actually spent in Twining. In addition, as in the county, the city clerk does not feel the town incurs any expenditures readily attributable to the tourists as opposed to the rest of the population. While most town expenditures will be spent on community residents, it is assumed that anyone who uses a central, commercial town such as Taos, places some burden on its budget. Since there is no way to easily identify this share, for a rough estimate we have again used the 3 percent figure. This is believed to overstate the actual expenditures due to TSV visitors. Of the town's 1978-1979 expenditures of $704,290, therefore, $21,129 will be attributed to visitors and residents in Twining.

Federal Revenue and Expenditures. In order to include all government levels which might be impacted, federal revenues and expenditures attributable to the Twining area have also been considered. The major revenue from the Twining area is the permit fee paid by Taos Ski Valley, Inc. for use of 1074 acres of Forest Service land. This fee is about $70,000/year. The Forest Service estimates that its costs directly attributable to the area are about $15,000 per year.

Analysis. A comparison of revenues and expenditures shows that skiers at Taos Ski Valley generated over $481,000 more in revenues than they required in government expenditures. Considering local and state governments, the figures are as follows:

Receipts	
Gross receipts collected from skiers by the State	$565,800.00
Expenditure	
State expenditure 78-79	$ 67,311.00
County expenditure 78-79	51,000.00
Municipal expenditure 78-79	21,100.00
Total expenditure	$139,411.00
Net Gain	$565,800.00
	-139,411.00
	$426,389.00

Numbers for the Federal Government are as follows:

Revenue (Permit)	$ 99,680.00
Federal Expenditures	- 15,000.00
Net Gain	$ 84,680.00

The calculations of revenue included only gross receipts tax collected by the State and the USFS permit fee; the revenues do not include taxes on property, gasoline, cigarettes, lodgers, liquor license fees or city sales tax; revenues generated from indirect spending are also not included.

D.4 IMPACT OF TAOS SKI VALLEY ON PROPERTY VALUES

Summary. The question has been raised to what extent the presence of Taos Ski Valley affects land values in the surrounding area.

A review of residential property values in Taos County and nearby communities indicates that the Ski Valley's impact on land values is prominent in the Twining-Amizette area. There appears to be a lesser impact on land values in the Valdez-Arroyo Seco vicinity. Beyond this area, land values do not appear to be directly affected by the Ski Valley.

It is possible that current conditions will change with time, particularly if pressure for development at the base of the mountain increases.

Methods and Data. To study the question of the Ski Valley's impact, a review of property values in the area was conducted. It was assumed that if Taos Ski Valley was having an impact on land values, then land values in the vicinity of Twining would be higher than for otherwise equivalent property elsewhere. Accordingly, the price of one acre of undeveloped, non-irrigated, residential land was compared for three types of areas:

1) valley communities - numerous communities in Taos County, as well as others in Rio Arriba, Mora, and Santa Fe Counties (refer to Table D-1);

2) non-ski mountain recreation areas - Valle Escondido, Chama, land on State Highway 4 west of Los Alamos;

3) ski recreation areas - Twining, Red River, Angel Fire.

The residential property values in each of these areas were determined based on research with local realtors, and are shown in Table D-1. It is recognized that many factors influence land values and that individual properties will vary from the figures shown in the Table. These figures, however, are representative.

Analysis. Referring to the table, several general relationships will be noticed.

Rural land in isolated areas ranges from a couple of hundred dollars per acre to a maximum of about $5,000 per acre; values are about $2,000 per acre in rural agricultural communities.

As properties get closer to a larger town, or in areas of prime agricultural lands within easy commute of a commercial center, values increase. Communities in these areas have land values which range from $5,000-6,000 per acre up to $10-15,000 per acre, with most communities in the $7,000-8,000 per acre range. Communities characterized by more expensive land were generally described by the realtors as having additional amenities (example: the attractiveness of Talpa to artists). Each of the areas is influenced by different factors which usually increase land values to the $10,000 per acre range.

In the major, commercial communities land values are again higher, about $15-20,000 per acre.

Ski and non-ski mountain recreation areas exhibit a striking value differentiation. In non-ski mountain recreation areas values are about $5,000-6,000 per acre while in ski areas values are up to $50,000 per acre and more.

A comparison of values in the Taos-Twining area to the general values described above identifies the impact Taos Ski Valley has had on land values in the County.

Land in Arroyo Hondo ranges from about $4,000-8,000 per acre, although generally it is about $7,000-8,000 per acre. These values are in the same price range as for most communities in the area. Since land is not more expensive than in areas such as Ranchos de Taos, it appears that land prices in Arroyo Hondo have either not been affected to any significant degree by the ski basin or at least have not been increased beyond values in other nearby areas.

Further upstream, in Arroyo Seco and Valdez, land prices are higher, $10,000 and $10-15,000 per acre respectively. This is higher than in most nearby communities, and is typical of communities (such as Talpa and Ranchitos) which are felt to have additional amenities. In Valdez, the additional value is reported to be largely due to the rural landscape and the scarcity of land for sale. In Arroyo Seco the area is attractive, and is accessible to both Taos and the ski valley. The effect of the ski basin on land prices is reportedly more apparent in Arroyo Seco than in Valdez. Since several factors are involved, the exact dollar impact on land values which is attributable to the presence of the ski valley cannot be determined. However, a comparison of values with those in other communities indicates that up to $2,000 per acre could be due to the ski basin.

In the Twining-Amizette area prices are again consistent with values in similar (ski) areas. On the other hand, as noted before, land values are much higher than in mountain recreation areas without ski facilities, by about $45,000 per acre. Therefore, most of the current value of properties in Twining and Amizette can be attributed to the presence of Taos Ski Valley.

Finally, the question remains whether land prices throughout Taos County are higher due to the presence of the ski basin. From the above discussion it appears that values in recreation areas are consistent with values in other counties. With regard to valley community areas, however, a different pattern emerges. Land values in the county are comparable to values for similar properties in other developing areas. Taos and Espanola, both regional commercial centers, have similar residential land values, $15-20,000 per acre. Correspondingly in both areas outlying communities are generally in the $7,000-8,000 per acre range. On the other hand, when compared to rural agricultural areas where there is less pressure for development, prices are noticeably higher. Land that would cost $5,000-10,000 per acre near Taos costs about $2,000+ per acre in La Madera and Ledoux. There are numerous factors encouraging development in the Taos area, of which the ski basin is one. It can be said that prices are higher in Taos due to the area's "amenities" which make it a desirable place to live for long-time residents as well as new comers. How much of the difference in value is due to the ski valley itself cannot be accurately determined.

D.5 BUYING POWER

One question of concern raised by the public was whether tourism, and TSV, Inc. in particular, caused the cost-of-living to increase more than it contributed to increased incomes. There is insufficient historical data for Taos to identify the changes in local spending patterns due to tourism and to determine with any degree of accuracy the impact TSV, Inc. has had on this change. However, some insights can be gained by a general review of the information which is available.

Studies. Generally, in communities heavily influenced by tourism, property and housing values and grocery prices tend to be higher than in communities which do not have noticeable tourism impacts (Flance, 1980). Further, most jobs generated by tourism are service jobs and low wages are common.

Data. If the conclusion reached by Flance is valid, then land, housing and grocery prices should be higher in Taos County than in nearby counties which are much less affected by tourism (e.g. Mora, Rio Arriba and San Miguel Counties).

Inflation is evident in land prices (see section D.4), especially when the highest price land in Taos County is compared with the most expensive land in (for example) Mora County. However, increased land prices are also evident in Espanola and elsewhere indicating that tourism alone is not responsible for the difference. Housing costs are strongly influenced by land costs. With land discounted, the costs of new housing are similar for Taos, Rio Arriba and Mora Counties, about $45,000 for a 'standard' 1000 sq. feet home (Best Way Realty, 1980; Trujillo, 1980). Used homes are also similar in Taos and Rio Arriba County, but may be a few thousand dollars lower in Mora County.

Based on newspaper ads for Safeway and Furr's stores, there is no major difference in grocery prices between the communities of Taos, Espanola and Las Vegas.

The median spending income in Taos is about the same as in Rio Arriba ($9,095 vs. $9,169 in 1979) and is higher than in Mora ($5,191).

The data indicate that the relationship observed by Flance may be true in Taos County, but if so the effects are small. This does not mean that Taosenos have adequate buying power or even that their economic status has improved in recent years; however, whatever major factors account for inflation in Taos are typical of the region as a whole, including areas not heavily influenced by tourism. It may even be argued that without the infusion of tourist dollars, the impact of inflation would have been much worse.

TABLE D-1. LAND VALUES.

Prices are in dollars, for one acre of undeveloped, non-irrigated, residential land.

Location	Price Range	Consensus
Ski Area		
Twining	45-75,000	50,000
Red River	10,000/lot	50,000
Angel Fire	28-48,000	28-48,000
Other Recreation		
Valle Escondido	3-6,000	5-6,000
Chama	5-6,000	5-6,000
St. Hwy. 4, west of Los Alamos	5-6,000	5-6,000
Valley Communities		
Taos County		
Taos	12-20,000	15-20,000
Arroyo Hondo	3-8,000	7-8,000
Arroyo Seco	8-10,000	10,000
Valdez	8-15,000	10-15,000
Talpa	7,500-10,000	10,000
Ranchos de Taos	7-8,000	7-8,000
Ranchitos	9-12,000	10,000
Los Cordovas	5-6,000+	5-6,000+
Questa	6-7,000	6-7,000
Penasco	1-7,000	3,000
Elsewhere		
Espanola	10-20,000	15-20,000
Santa Cruz	10-15,000	10,000+
Chimayo	7-14,000	10,000+
Abiquiu	4-8,000	6-8,000
Velarde	3-8,000	6-8,000
Ledoux	2,000	2,000
La Madera	2,000	2,000
Tierra Amarilla	2,500	2,500
Tres Piedras	250	250

Source: Lee Wilson & Associates, Inc., May 1980. Based on conversations with Angel Fire Corporation, Best Way Realty (Santa Fe and Espanola), Lota Realty, Ben Maestas, Mares Realty, Martinez Development Company, Polson-Mercer Realty, Taos Mountain Realty, Territorial Realty Inc., Ron Sebesta Realty, and others.

APPENDIX E
COORDINATION

APPENDIX E. COORDINATION

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June 24, 1974

Mr. William D. Hurst
Regional Forester
U. S. Forest Service
517 Gold Avenue, S. W.
Albuquerque, New Mexico 87102

Dear Mr. Hunt:

The Draft Environmental Statement on the Taos Ski Valley Expansion Proposal confirms that the project will have nothing but adverse environmental effects upon the Rio Hondo watershed and adjacent areas. Destructive elements predicted by the Statement include erosion, loss of vegetative cover, water-, air-, and noise-pollution, litter and disruption of water supply. No realistic and effective safeguards are proposed to prevent destruction of the Wheeler Peak and Blue Lake Wilderness Areas by the great numbers of people, their vehicles, and the facilities to serve them that will be introduced into this fragile area. Nor is there any showing that such remedial measures as are proposed to counter the admitted damage would be economically feasible for private developers or for the Forest Service.

The adverse impact upon the adjacent Wheeler Peak Wilderness Area, the Blue Lake Area, and the regional water supply, including the Rio Lucero, are paramount concerns of Taos Pueblo. None of these major problems is given complete and accurate attention by the Statement. The rapid deterioration of the Wilderness Area from overuse has been described in the Forest Service's recently published Draft Management Plan for that area. Yet the Statement actually cites as a benefit the improved access that the project will afford to the Wilderness. Thousands of people will be brought to the area's periphery for winter and summer recreation. Short of posting guards along the borders, patrols and full-time cleanup crews within the area, nothing can stop the destruction of the fragile watersheds within the Wilderness from such an onslaught. The Statement merely calls for reliance on a proposed Wilderness permit system, failing entirely to consider the monumental problem of enforcement.

The destruction could not and would not be confined to the Wheeler Peak Area, but will spread inevitably into Taos Pueblo's own Sacred Blue Lake Area. The proposed new village would be located at the back door of these areas. It would menace the peace and security of our religious shrines, which our people have for so long struggled to preserve at great sacrifice. It would open our lands to littering, noise, traffic, trespassing, forest fires, erosion and other damage.

By facilitating the use of public lands in connection with the project and thus endangering both the Wheeler Peak and Blue Lake Areas, the Forest Service will come into direct conflict with two Acts of Congress, which require preservation of these lands as wilderness forever.

Any disruption of the water supply in the area threatens all of us who live there. According to the Environmental Statement, "Increased stream flow may result from clearing of ski trails, parking lots, and buildings". No explanation for this prediction is given; the Statement merely suggests that an existing gaging station will determine how substantial the increase is after the project is constructed.

A similar situation was experienced on the Rio Grande del Rancho, and the effect was disastrous for the farmers downstream. In that case clearings in the watershed for logging roads and skid trails caused rapid melting of the snowpack in April and May, leaving little runoff for irrigation during the critical later months of the growing season, and also reducing replenishment of the underground basin.

The Rio Hondo project not only will create a similar problem as the result of substantial clearings, but may produce a rise in temperature caused by habitations, burning fireplaces, anticipated traffic congestion, sewage treatment plants, and all the other accoutrements of a permanent community. A great deal is said in the Statement about pollution from those sources, but nothing about their effect on temperatures and melting of the snowpack. Certainly, there must be data available concerning these factors from similar projects elsewhere. Furthermore, projections computed from known factors, such as amount of land to be cleared, should be made in order to estimate the effect on runoff.

Because of its failure to produce information and data on any of these matters, the Draft Environmental Statement as it stands does not meet the standards for evaluating the impact of a major federal action. The actual impact of the project upon the Wheeler Peak and Blue Lake Areas will clearly be unmanageable; the effect upon the water supply, downstream irrigators and underground basin will very possibly be disastrous. Taos Pueblo therefore opposes any action by the Forest Service, including the grant of a right-of-way over public lands for a road, that would facilitate construction of the proposed village or the expansion of Taos Ski Valley facilities.

Yours very truly,

TAOS PUEBLO COUNCIL

BY: ______________________
Teresino Jiron, GOVERNOR

March 26, 1981

Citizen's Advisory Committee
Twining Sanitation District
Public Meeting, March 31, 1981

Statement of Concerns of the Taos Pueblo Council and Community

I have here a letter that was written by former Governor Teresino Jiron and the Tribal Council of Taos Pueblo in 1974 to the Regional Forester expressing their concerns about the expansion of Kachina Village at Taos Ski Valley. Governor Jiron's and the Tribal Council's concerns as expressed in this letter reflect the permanent values of an ancient relationship the Pueblo has with its surroundings. The truths expressed herein have not changed since the beginning of time.

In the past sixty five years, Taos Pueblo has gained a reputation for its tenacity in appealing to the Government for the rightful deed to its sacred lands. In an unprecedented case, President Nixon signed a bill which returned those lands to their original stewards. Since that time, a new spirit of optimism has grown in the hearts of the people. Young people exhibit a renewal of cultural pride as they take part in the intensive ceremonies. The changes outlined in the letter of 1974 concerning the Kachina Village expansion are not unlike those suggested by today's Taos Ski Valley expansion plan. There is no reason why the plan would be any more acceptable to the Pueblo Indians today than it was in 1974.

We have a history of preserving and defending our land. We love the one that stands up there. That mountain is sacred. We love the pure water

coming from the highest mountain plateau through the Pueblo. Those waters come from the source, the head, and that source is not made by a human being - it is made by God. He is the father. He creates me and he creates you. That's the Indian way of life. That's the Indian bible. The Indian feels that water is very sacred. Without clean water, we cannot survive. Mother nature grows those trees and those big mountains. God has struggled to give us this life. Water is what makes us the way we look, what we are today.

When Governor Jiron and the Tribal Council wrote of their concern for the "peace and security of our religious shrines", there was no legal recourse for the Pueblo. In 1979, however, a law was passed to guarantee our sacred shrines. The American Indian Religious Freedom Act guarantees access, preservation, and protection for all religious properties held by Native American tribes. To the Taos Pueblo people all water sources, the springs, rivers, and lakes are sacred. Any damage or alteration of those sacred entities is a violation of the American Indian Religious Freedom Act.

Taos Pueblo is prepared to participate in the draft process of the Environmental Protection Agency's Environmental Impact Statement. The Pueblo's concerns include other factors than the protection of religious shrines. Taos Pueblo has a past history of trespass violations on border lands adjacent to Taos Ski Valley. There a currently a number of land disputes between the neighbors of Pueblo lands. Increased expansion of Taos Ski Valley would further aggravate this problem. The past ten years has seen a dramatic increase in summer as well as winter use in the Taos Ski

Valley. The Pueblo leaders already have a full burden patrolling the borders. There must not be an increase in trespass violations or desecrations of our sacred lands.

The following factors must be considered by the Environmental Impact Statement:

1. Increased violations of Sacred Land or curtailment of access to those lands.
2. Water quantity and quality alterations, such as to the Rio Lucero.
3. Development of more residential growth bordering Indian lands and the possibility of further land disputes being produced by continued expansion.

The Taos Pueblo maintained the position stated in its letter of 1974 to the Forest Service. Moreover, the queries that arise from that letter and this statement should be answered by the EPA Environmental Impact Statement. The Pueblo will assist EPA in any way possible to provide up-to-date data leading to a fair and correct assessment of the situation.

Sincerely yours,
TAOS PUEBLO TRIBAL COUNCIL

Paul Bernal
Tribal Council Secretary

UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE

POST OFFICE BOX 1306
ALBUQUERQUE, NEW MEXICO 87103

IN REPLY REFER TO:

SE

RECEIVED
OCT 17 1979
EPA
REG. VI
S & A DIV.
FED. ASST.

October 12, 1979

Mr. Clinton B. Spotts
Regional EIS Coordinator
U.S. Environmental Protection Agency
1201 Elm Street
Dallas, Texas 75270

Dear Mr. Spotts:

This is in reply to your September 17, 1979 letter which requested information about species which are listed or proposed to be listed as threatened or endangered as provided by the Endangered Species Act. Your area of interest is the Twining Water and Sanitation District, Taos County, New Mexico.

As provided by Section 7(c) of the Endangered Species Act Amendments of 1978, the Fish and Wildlife Service is required to furnish a list of those species, both proposed and listed that may be or are present in the area involving Federal construction activities.

Upon receipt of the Fish and Wildlife Service's species list, the Federal agency authorizing, funding, or carrying out the construction action is required to conduct a biological assessment for the purpose of identifying listed species which are likely to be affected by such action. Proposed species are included on the list even though they do not have legal protection under the Act. Their inclusion recognizes that they may be listed anytime and have the portent to cause delays or modifications to the proposed action. In light of this, we recommend that those species be included in the biological assessment.

The biological assessment shall be completed within 180 days after receipt of the species list, unless it is mutually agreed to extend this period. The biological assessment should include: 1) the results of a comprehensive survey; 2) results of any studies undertaken to determine the nature and extent of any impacts on identified species; 3) consideration of the cumulative effects upon the species or its critical habitat; 4) study methods used; 5) difficulties encountered in obtaining data and completing the proposed study; 6) conclusions including recommendations as to further studies, and 7) any other relevant information.

CONSERVE AMERICA'S ENERGY

Save Energy and You Serve America!

For purposes of providing interim guidance, the Fish and Wildlife Service considers construction projects to be any action conducted or contracted by the Federal agency designed primarily to result in the building or erection of man-made structures, such as dams, buildings, roads, pipelines, and the like. This includes consideration of major Federal actions such as permits, grants, licenses, or other forms of Federal authorization or approval which may result in construction and which significantly affect the quality of the human environment. In addition, other actions that have the potential of becoming or are controversial, may be considered as construction.

If the biological assessment reveals that the proposed project may affect listed species, the formal consultation process shall be initiated by writing to the Regional Director, Region 2, U.S. Fish and Wildlife Service, P. O. Box 1306, Albuquerque, New Mexico 87103. If no affect is evident, there is no need for further consultation. We would, however, appreciate the opportunity to review your biological assessment.

The attached sheet provides information on species which may occur in the proposed project area. If we may be of further assistance, do not hesitate to call upon us (505-766-3972; FTS 474-3972).

Sincerely yours,

Acting Regional Director

Twining Wastewater Treatment Plant
Taos County, New Mexico

LISTED SPECIES

Bald eagle (Haliaeetus leucocephalus)

May be found as a winter resident and or migrant along the Rio Grande and tributaries. Also recorded in the Sangre de Cristo Mountain area in summer. This water oriented eagle feeds largely on fish though also takes waterbirds and mammals.

Peregrine falcon (Falco peregrinus)

This species, a summer resident of the area, typically hunts waterways for food. Nest sites are associated with cliffs and bluffs of gentle terrain.

PROPOSED SPECIES

None.

CRITICAL HABITAT

None.

DEPARTMENT OF THE ARMY
ALBUQUERQUE DISTRICT, CORPS OF ENGINEERS
P. O. BOX 1580
ALBUQUERQUE, NEW MEXICO 87103

SWACO-OR

13 September 1979

Ms. Adlene Harrison
U.S. Environmental Protection Agency
1201 Elm Street
Dallas, TX 75270

Dear Ms. Harrison:

Reference is made to your notice of intent regarding Section 201 Grant C-35-1064-01 for the Twining Water and Sanitation District, Twining, New Mexico.

Review of your notice indicated a Section 404 Permit will be required if dredged or fill material is deposited into the Rio Hondo below the ordinary highwater mark or into an adjacent wetland.

The Environmental Impact Statement for this project should include a discussion of the need for a Section 404 Permit and for compliance with Section 404(b) guidelines.

Should you have any questions regarding these matters, please do not hesitate to write or call Mr. Wayne Lee or Mr. Andrew Rosenau at (505) 766-2776 or FTS 474-2776.

Sincerely,

for
RICHARD D. BLUM, P.E.
Chief, Construction-
Operations Division

STATE OF NEW MEXICO
DEPARTMENT OF
FINANCE AND ADMINISTRATION
STATE PLANNING DIVISION

505 DON GASPAR AVENUE
SANTA FE, NEW MEXICO 87503
(505) 827-2073
(505) 827-5191
(505) 827-2108

BRUCE KING
GOVERNOR
KATHLEEN R. MARR
SECRETARY

ANITA HISENBERG
DIRECTOR

JOE GUILLEN
DEPUTY DIRECTOR

July 22, 1981

Mr. Stevan Anderson
Lee Wilson and Associates
P. O. Box 931
Santa Fe, New Mexico 87501

Dear Mr. Anderson:

This letter is in response to your request for information on the archaeological, historical and cultural sites within the Twining Wastewater Facility Improvement Project area. You state in your letter that the preferred alternate will involve the replacement of the existing treatment plant, the replacement of existing sewer lines, with only one new hook-up planned.

No properties entered in or eligible for nomination to the National Register of Historic Places are presently known to exist in the immediate vicinity of the project location. In addition, since construction of the new treatment facility is to be confined to the existing treatment plant site, it is highly unlikely that any archaeological resources will occur at the project location. Provided that construction activities are restricted to the existing treatment facility site and that work on sewer lines will also involve replacement, with the exception of the single new hook-up, it is our opinion that this undertaking will have no effect on any significant cultural resources.

You should be advised that alterations to plans for the described project will require further review by this office. We also wish to inform you that buried archeological manifestations may be uncovered by construction activities. If such manifestations are uncovered, artifacts and features should be protected in place and this office notified immediately of the find.

Should you have any questions regarding our comments, do not hesitate to contact this office.

Sincerely,

Thomas W. Merlan

Thomas W. Merlan
State Historic Preservation Officer
Historic Preservation Bureau

TWM:CJLB:jmg

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